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BIOLOGICAL STANDARDISATION OF DRUGS

Introduction

VOLTAIRE defined 'therapeutics' as the pouring of drugs, of which one knows nothing, into a patient, of whom one knows less. Much water has flowed under the bridges since the above statement was made and fundamental advances have taken place in our knowledge of the chemistry and pharmacology of drugs as well as in the symptomatology and pathology of many disease processes in human beings. But the ancient sneer of Voltaire still expresses the general truth that there are *two variables* in therapeutics—the *patient* and the *drug*. As is well known, it is impossible to control two independent variables and, therefore, it is necessary to see which of the two we can standardise to our advantage. With regard to the *patient*, it is important to realise that no two individuals respond to any drug in an identical manner. Leaving aside certain abnormal cases of hypersensitiveness or idiosyncrasy so frequently met with in medical practice, considerable amount of evidence is available to show that there is a wide individual variation even in healthy individuals in the dose of a drug needed to produce an equal effect. If healthy patients do not react in an uniform manner, it is too much to expect that *diseased* human beings, on whom drugs are ordinarily intended to be employed, would respond uniformly. Such being the case, it is futile to attempt to standardise the patient. The only alternative, therefore, in the interest of the safety of patients and to ensure accuracy in therapeutics, is to standardise the other variable—*the drug*.

Physical, Chemical and Pharmacognostic Assay

How can this standardisation be effected? The accurate use of drugs in therapeutics involves that the amount of the active principles given in each dose must be known or, at any rate, must not be subject to irregular variations. The majority of drugs that are used today are derived from vegetable, mineral and animal sources, and the estimation of the active ingredients in each of them can usually be done by the employment of well-known physical and chemical methods. In the case of vegetable remedies, a combination of botanical and chemical methods are often found adequate. Accepted methods for the standardisation of most of the drugs in common use are given in the recognised pharmacopœias, *e.g.*, the British Pharmacopœia, British Pharmaceutical Codex, the United States Pharmacopœia, the National Formulary, etc., and these methods can be easily employed by all laboratories engaged in the standardisation of drugs, medicinal, chemical, insecticides, cosmetics, etc.

Biological Assay

During the present century a group of potent substances, *e.g.*, hormones, vitamins, biological substances, etc., have been introduced into therapeutics whose active constituents are insufficiently known or when known, cannot be easily isolated quantitatively. Some of them are potentially dangerous and in many cases, for their safe and effective use, they must be administered by precise dosage. Since these cannot be assayed by chemical means, other methods depending upon their action on intact living animals or surviving isolated organs or tissues have to be adopted.

In the devising of these methods, advantage is taken of the fact that each of the substances exhibits *specific* biological properties. Thus, insulin administered to animals causes a reduction in the concentration of the blood sugar, old tuberculin produces a typical and specific

action when injected into tuberculous animals, administration of the vitamins to suitably-prepared animals will restore growth, cure scurvy, rickets and other diseased conditions, many of which can be experimentally produced in animals, and so on.

The principle underlying biological assay, as distinguished from chemical assay, is that a certain quantity of a drug will always produce the same degree of deflection from the normal in the same animal or in animals of the same species. This is not always absolutely true, for many conditions may alter the extent to which an animal reacts to a drug, and every precaution must be taken to keep all conditions identical in carrying out these tests. For example, the reaction varies inversely with the weight of the animals, and these must be taken as nearly identical as possible, and the dose must be calculated in terms of the weight of the animal. When great accuracy is required, the test must be done upon a series of animals sufficient to eliminate the variations and idiosyncrasies that cannot be controlled under ordinary circumstances.

The Importance and Scope of Biological Assay

The first official recognition of bio-assay was made in the ninth revision of the United States Pharmacopœia, 1916, by the inclusion of a physiological method of standardisation for cannabis and pituitary extracts. Since then, the method has gained steadily in importance and has been extended to a fairly large number of substances including biological products, such as antitoxic sera, vitamin and endocrine preparations, chemical transmitters, *e.g.*, acetylcholine, synthetic compounds, *e.g.*, organic arsenicals and antimonials, chemotherapeutic remedies, *e.g.*, antimalarials, antibactericidals, etc., insecticides, disinfectants and other groups of drugs of the type of digitalis and similar glucosides, ergot, aconite, etc.

Though a comparatively new method of standardisation, the utility and reliability of bio-assay have been established beyond doubt. The recent isolation of various hormones in chemically pure form and the newer ideas regarding the chemical transmission of nerve impulse are some of the fruits of biological assay. Drugs such as insulin or liver extract could not have been brought into clinical use unless it was possible to ensure a uniform product through biological standardisation. This method is also indicated if the chemical assay does not give a true value of the activity of the drugs, even when the active principles are chemically known. Thus, chemical assay may fail to separate optical isomers, such as *l*- and *d*-adrenaline, which differ greatly in their physiological activity. The efficiency of a new remedy may be judged with the action of a known sample by means of biological assay. It has also been found valuable for the detection of small quantities of potent poisons in the body organs, blood or urine. Furthermore, biological assay is needed to supplement chemical assay in order to observe undesirable toxic effect or to gauge efficient therapeutic activity. An example of this is to be seen in the case of the arsphenamine group of drugs. This can be obtained as pure synthetic compounds of known chemical composition but minute differences in their toxicological behaviour have been found to exist from batch to batch. The animal body can detect such differences which are too fine to be identified by chemical or physical tests. On the whole, the great sensitivity of biological assay is an advantage over chemical assay. Thus, we can easily estimate acetylcholine or adrenaline in a dilution of one in one hundred millions or more. At present we do not know of any chemical method to detect or estimate such extraordinarily small quantities.

In spite of its advantages in certain directions, the biological assay methods must be regarded in most cases as merely a 'stop-gap' which allows the strength of drugs to be controlled before the chemical methods have been developed. Biological tests for some vitamins and hormones have already been replaced by physical and chemical methods, and this process will doubtless continue. Thus the preparations of ergot used to be assayed by the B.P. and is still being assayed by the U.S.P., by biological method. The chemistry of the active constituents of ergot are now better known and it has been found possible to standardise it by means of a colorimetric method. In the case of thyroid preparations also, the biological method has been largely replaced by the chemical method which determines the total iodine content of the glands. However, when biological methods and chemical methods for the assay of a pharmacologically active substance disagree so widely that the disagreement cannot be due to the error of the tests (as is sometimes encountered in hormone research) the biological method is, by definition, right and the chemical method must be assumed to be wrong.

Biological Standards and Their 'Units'

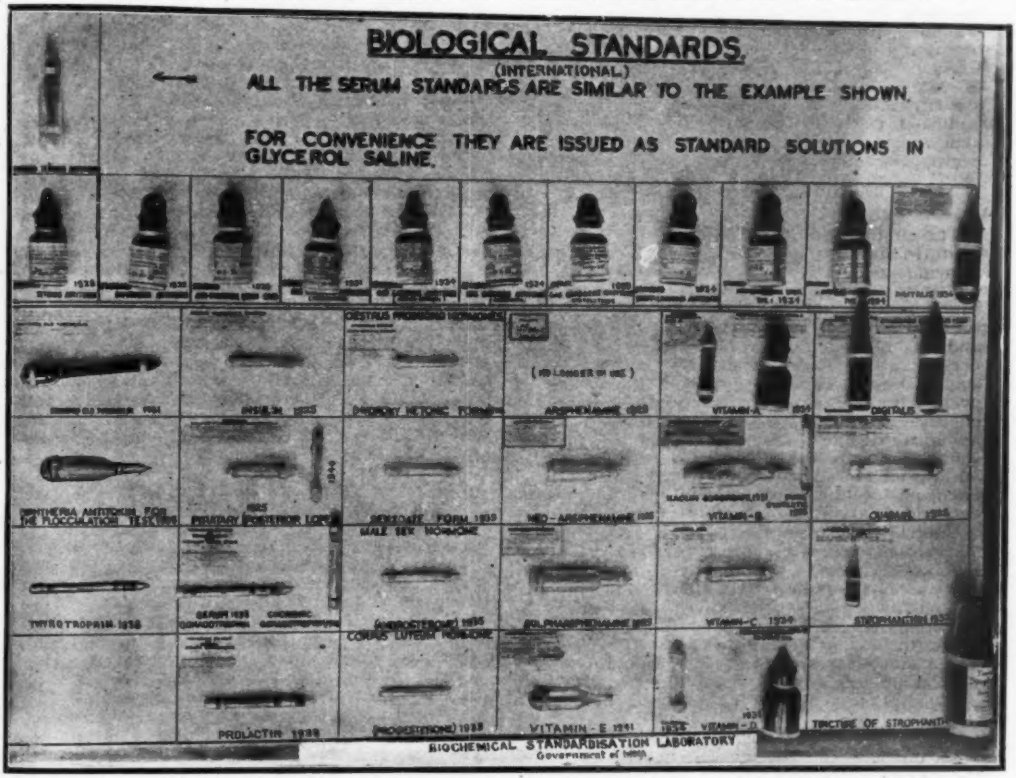
In biological assay, the object is to compare the effects of a preparation with those of a *standard* and whenever possible this standard should be a single, stable and pure chemical substance. For certain vitamins and hormones, for instance, it has already been found possible to take the active substances in chemically pure form as the standard, and to define this by its physical and chemical constants. In the case of adrenaline preparations, for example, there is no prescribed standard. It can be assayed against pure and *l*-adrenaline which is readily obtainable. But this is not always possible and biological standards have often to be employed in cases when a standard in a pure chemical form is not available. Where biological standards are used, the reason is that preparations issued for therapeutic use do not usually contain the active substances in its pure form and are frequently mixtures; so long as these conditions prevail, any method of assay other than the biological will accordingly be unpracticable.

But to have a *standard* preparation is not enough; its action must also be measurable and expressible in terms of a unit of activity. As has already been emphasised, it is not possible to determine the potency of any of these substances by simple observation of the effects

produced in an animal or a small group of animals. It is, however, possible to find out how much of a preparation, the potency of which is unknown, will produce the same bioloical effect as a definite quantity of another preparation the potency of which is known, provided the tests are carried out under strictly comparable conditions. The recognition of this fact has led to the definition of a biological '*unit*'. This indicates the degree of *specific biological activity contained in a certain weight of the standard.*

International Standards

The decision to have the question of biological standardisation internationally studied was taken by the League of Nations' Health Committee at its second session at Geneva in 1921. In 1924, the Health Committee decided to set up a Permanent Commission on Biological Standardisation consisting of experts from various countries. The Commission decided first, to establish *standard* preparations and second, to select *units* to express their potencies. By international agreement, a number of International Biological Standards have now been established and are available for use all over the world through 'national' distributing centres, so that a common notation and a common standard of reference are available to all research workers, assay laboratories and manufacturing institutions (see picture).



1st Row.—Tetanus Antitoxin (1928); Diphtheria Antitoxin (1922); Anti-Dysentery Serum (Shiga), (1928); Gas Gangrene Antitoxin (Perfringens, 1931); Gas Gangrene Antitoxin (Vibrion Septique, 1934); Gas Gangrene Antitoxin (Oedematiens, 1934); Gas Gangrene Antitoxin (Histolyticus, 1935); Staphylococcus Antitoxin (1934); Anti-Pneumococcus Serum (Type I, 1934); Anti-Pneumococcus Serum (Type II, (1934); Digitalis (1936).

2nd Row.—Old Tuberculin (1931); Insulin (1925); Oestrus-producing Hormones (Hydroxy-ketonic form, 1932); Arsphenamine (1925); Vitamin A (β-Carotene, 1934); Digitalis (1925); Digitalis (Brit. Std.).

3rd Row.—Diphtheria Antitoxin for the Flocculation Test (1935); Pituitary (post lobe) (1925; 1940); Oestrus-producing Hormone Mono-benzoate of Dihydroxy form (1935); Neoarsphenamine (1925); Vitamin B_1 (standard absorption product, 1931) (Pure synthetic, 1938): Ouabain (1928).

4th Row.—Thyrotrophin (1938); Gonadotrophins (Serum, 1938) (Chorionic, 1938); Male Hormone (Androsterone 1935); Sulpharsphenamine (1925); Vitamin C (*l*-Ascorbic acid) (1934); Strophanthin (Brit. Std.).

5th Row.—Prolactin (1938); Corpus Luteum Hormone (Progesterone, 1935); Vitamin E (1941); Vitamin D (Irradiated ergosterol, 1931) (Calciferol, 1934); Tinct. of Strophanthus (Brit. Std.).

Methods of Biological Assay

While the Standards Commission recommended suitable methods, the methods remain open to progressive modification and improvement or discovery of a new method in accordance with experience and research in this field of study. The methods may vary while the activity of the standards is immutable. It is important that the method of assay must be one which measures the important therapeutic principle. Several different methods can be used, provided they measure the same active principle. The result of assay should be the same whatever method is used, and in every case, a 'control' assay should be run with the 'standard', side by side with an unknown sample using the same technique. In general, the methods of biological assay may be divided into two classes:—

(A) *The "All or None" Reaction.*—The 'all or none' biological response indicates that a given reaction is either present or absent. Although perhaps, 'death' occurs more frequently than other end points, the method has been applied to many criteria, such as convulsions, systolic standstill of the heart, the presence of cornified cells in the vaginal epithelium, negative blood smears and survival in a therapeutic test. The biological assay based upon the toxicity test, the assay of œstrogenic hormones and vitamin B are familiar examples of this type of measurement.

(B) *The 'Graded Response' Reaction.*—Another large group of assays depend upon a graded dose-effect response, where the extent of the reaction varies with the dose. Examples are the hypoglycemic response of the rabbit to insulin, the height of contraction of guineapig uterine muscle to posterior pituitary extract, the level of serum calcium in the dog following treatment with parathyroid extract, and the growth of depleted mice under different dosages of vitamin A. Since each individual reaction is quantitative rather than qualitative, it contributes more information per animal than in the preceding type or assay. It is important, however, to choose a dose for the *standard* and for the *unknown* sample, which produces a *median* response. An essential requirement for assay is that equal active doses should produce equal effects. Further, a significant difference in dosage must give rise to an unmistakably different effect.

Sampling Error in Bio-Assays

The most serious difficulty in biological assay is that due to the variability of the 'test objects', *i.e.*, living animals and some of the most serious errors have arisen from a failure to appreciate its true dimension. This error is called the "sampling error". No physiological method has any value which does not eliminate or estimate the animal variations. Two kinds of variation have to be considered: the relatively persistent differences of sensitiveness between one individual and another, and the variations of sensitiveness seen in a single individual from day to day, or in a single isolated organ or tissue during the course of an experiment.

Individual variations can be eliminated when the same animal or organ can be used for successive or alternate tests. But even in this case the variations from one time to another are not eliminated. In fact only too often the animal may become sensitised.

When the assay is carried out on different groups of individuals, the difficulties are greater. It is a common habit to assume that, if the results obtained from three successive animals happen to agree, the right answer has been obtained, further results which do not happen to agree being discarded. Such a habit of discarding some unwelcome figures introduces an error in biological assay. If in ten estimations, for example, nine give reasonable agreement and the tenth is considerably higher, the mere fact that the tenth has occurred means that the true *mean* is a little higher than the figures which apparently agree. The operation of the 'law of averages' is important in biological assay.

Fortunately, the sampling error can be estimated by statistical computation. We can, by employing the well-established laws of mathematics, calculate whether the difference in the average potencies of two samples is merely due to variation in the animals selected or is actually 'significant' ('T' value) and is to be taken into account. Similarly, by applying the computation of 'Probability' ('P' value), we can find the best number of animals to employ in an experiment by which an accurate result can be obtained. However, the mechanism of the physiological action of drugs is of so complex a nature that numerous factors may introduce serious errors in the estimated results. It is easy to familiarize oneself with the technique of bio-assays but it is difficult to eliminate or judge the various errors likely to occur. No biological assay can be considered valid unless it takes into consideration all the principles enunciated above.

Bio-Assay of Drugs in India

With the advice of Sir Henry Dale, F.R.S., N.L., lately Director of the National Institute for Medical Research, London, Prof. R. N. Chopra first introduced biological methods for the standardisation of digitalis preparations in the laboratories of the School of Tropical Medicine, Calcutta. Meanwhile, biological standardisation of sera, vaccines, antitoxins, etc., was being carried out at the Central Research Institute, Kasauli, and at the Haffkine Institute in Bombay. Under the able guidance of Sir Robert McCarrison, the Nutrition Research Institute at Coonoor, South India, also adopted approved methods for bio-assay of vitamins and vitamin products.

The much-needed fillip to the wider employment of standardization procedures in the field of drugs came through the establishment by the Government of India of the Bio-chemical Standardisation Laboratory under the direction of Sir R. N. Chopra. Though far from ideally equipped and not endowed with facilities commensurate with the intensity and importance of the task it is required to tackle, this Laboratory, during the last six years of its existence, has made significant contributions to this difficult field of work and by advice and guidance, has enabled the drug industry in India

to launch newer projects in the manufacture of glandular products and modern chemotherapeutic remedies. Previous to the establishment of the Bio-chemical Standardisation Laboratory, opinion with regard to the physiological potency and therapeutic efficacy of products of this group could only be obtained from Britain, Germany or America. In the present state of India's progress in the field of drug manufacture, there is need for increased emphasis in the direction of biological standardization side by side with the development of synthetic and applied chemistry. There is need also for the development of 'Therapeutic Research Institutes' on the lines of the Nuffield Institute in Oxford where experimental medicine and clinical trial of promising drugs on human patients could be undertaken to supplement observations made in the biological standardization laboratories. Only by such organised efforts can India be made self-sufficient in the matter of her drug supply.

B. Mukerji.

THE WAY AND SPIRIT OF SCIENCE*

By Generalissimo CHIANG KAI-SHEK

(Chairman of the Military Affairs Commission of the Republic of China and Supreme Commander of the Chinese Armies)

The Scientific Approach

PROCEED from the immediate to the distant, from the low to the high; attain the great through the small, the difficult through the simple. To accomplish great and important things, it is necessary to start from the nearest, simplest, and most minute matters, enlarging and expanding gradually in systematic order.

Competence in small things preceeds competence for big affairs; first know how to do commonplace things well; afterwards talk of doing work of special importance. Know how to solve small and easy problems; afterwards you may be successful in rare accomplishments. Never run after speculations and far-reaching conclusions, missing out immediate stages and hoping for lucky shots. Your work will only be superficial; short cuts will not lead to the desired aim, and nothing solid will be accomplished.

The Scientific Spirit

In order to investigate thoroughly all the phenomena of man and Nature, our attitude towards anything should be, not only to attempt understanding of what is not understood, and to make experiments where the previous experiments have not been satisfactory; but also to understand further what is commonly supposed to be already understood, and to improve further those experiments which have already been commonly considered satisfactory. The more knowledge grows, the more the lack of it is felt. The greater one's accomplishment, the more intensely the smallness of one's ability is realized. But it is through this very feeling of inadequacy and insignificance that knowledge and achievements can continually progress.

Never be satisfied with obtaining one result or even a small success. Whatever be the department of knowledge one is investigating or whatever kind of work one is to do, it is necessary before starting to consider properly the facts of the case, avoid all vagueness in defining the aim and be sure about the method to be employed. Once started, be determined to carry the project through, working unceasingly and meeting every obstacle with undaunted resource.

Many young men of to-day have no understanding of this principle. They will start to study a subject or work on a project, but when they meet the slightest obstacle or disappointment, instead of holding on doggedly and industriously, they will merely skip the difficulty and turn over to some other easier problem. This mental unsteadiness, chopping and changing time after time, will never bring any result.

There are also many who have as their main object in life the attainment of wealth or high official position, and if they find themselves engaged in work where these aims seem to have little or no hope of realization, they will discard it without any consideration, however important it may be, and creep into some new path. Such opportunists, consulting only their own selfish interests, have no responsibility to the country and the people.

The Scientific System

Limitations. In doing anything we must first know the limitations of the question; in other words, one must be quite clear about one's object and aim. This is of prime necessity, for one can then concentrate time and energy upon possibilities within the frame of reference. Thus one can avoid all distractions from other sources; and one will not try to do several things at once. If we think of attacking one problem to-day, another tomorrow, and still another the day after to-morrow, finally nothing will be accomplished. In investigations and affairs it is essential to define the central idea. Only if this is done can we distinguish between the roots and branches of things, avoiding confusion between the first and the last. A clear idea of the order of things, which stands the test of practice, is required for the success of any research.

Management. All reasonable scientific organization must satisfy the following requirements: (*a*) a vertical definite dendritic order; (*b*) a horizontal intimate co-ordination. The vertical order embodies the relation between

* Abridgment of an address by Generalissimo Chiang Kai-shek, given in 1942; translated by Huang Hsing-Tsung and Dr. Joseph Needham, F.R.S. Note that the word "Way" has a special significance in Chinese philosophy. The address is posted in all Chinese Government laboratories and workshops.

the upper and the lower, the deriving to the derived, levels of organization. Such relation must be well understood before the organization can be effectively controlled and steered with ease. The horizontal co-ordination embodies the relation between each small part of the organization to every other part, so as to give harmony in operation. Such relations must be intimate before the different portions can achieve complete co-ordination, and the organization run with maximum efficiency.

Recording and Preparation. Before beginning work on any subject, collect every type of material available, examine it carefully, and presuppose all possible situations which may be encountered at different later stages, using all possible intelligence and resourcefulness. Consider the preparation of different types of formulæ to meet different situations so that at any stage of the work the most satisfactory formula can be produced. Only those who are thoroughly industrious and persevering in thought, only those who have different solutions and formulæ prepared beforehand, can meet every situation with calmness and ease. However difficult the matter in hand may be, in the end they find the solution which carries them through.

Division of Labour and Co-operation. The advance of human civilization has been entirely due to division of labour and co-operation. Whether it be knowledge or practical affairs, division of labour is necessary for specialization, and co-operation is necessary for success. For the intelligence and ability of one single man are limited; hence each man has to select a particular branch of knowledge for investigation or a special type of practical work to do; only then is the highest efficiency attained. Then the results of different investigations have to be unified and co-ordinated, and the entire whole of knowledge and achievements makes real progress. We Chinese suffer from a great lack of co-operation in knowledge and affairs. In our scholarly researches there is not enough discussion and mutual understanding; and in our affairs there is little sympathetic and helpful co-ordination; thus the research spirit is low and few things are done well and effectively.

Research. The progress of science and the improvement of the lot of man have been due to the efforts of research. These were not accomplished by people who are content to work to strict office hours. In the West, work is carried on not only in the normal working hours, but even free time is not wasted. For example, Sundays have been found just the right time for intellectual investigations. If we are to save our country, we must break through the present lethargic and pessimistic psychology, and cultivate an industrious and persevering spirit, dedicating oneself to research with all one's heart and mind.

Experimentation. Many of the results of investigation and observation are only theories which have to stand the test of experiment before it can be shown whether they are correct and suitable for practical purposes. If experimentation shows flaws in the theory, then it is necessary (according to the facts of the case) to study more carefully, trying various improvements until as satisfactory a hypothesis is obtained as possible. If one still fails, the reasons for failure must be further inquired into, and corrections made accordingly. The ideal type of research worker is one who stands firmly by the scientific attitude (the objective outlook), observes facts and circumstances objectively and with humility, and draws his conclusions therefrom. Then only will there be any hope of knowing the truth.

Analysis and Statistics. When any plan or project of work shows development at the experimental stage, whether good or bad, one must collect and analyse the mass of material on hand, find out where the defects or good points are, decide whether the plan is workable and how far progress has been made, and in which direction and along what lines future developments are to take place. This statistical and analytical ability and the power for precise decision are fundamental in the success or failure of our research or practical work. Without the analytical and decisive mind it will not be possible to see clearly and objectively the relevant facts, and one falls into a mental state of chaos and disorder, failing to discover any likely approach to a successful conclusion.

Improvements and Inventions. To be conscious of mistakes is the most important factor in making progress. So in all our analytical examinations it is imperative to find the causes of these mistakes; only in this way shall we be able to find the required improvements. We must also persevere to discover those new principles, new methods, and new factors which are essential for general progress.

Conclusions. We live in an era of difficulty, suffering and danger. To be able to shoulder the heavy responsibility of reviving our nation and completing our revolution, we must have at all costs a clear idea of the content and meaning or science; we must propagate the spirit of science; and we must utilize the methods of science; so that one man will be as efficient as ten, and in one day ten days' work will be done. While we are fighting intensely at the front for the mode of life we want, we cannot remain stationary at home; if we do not progress we shall degenerate; if we cannot achieve success we shall be ruined; if we do not prosper we shall be crushed; if we still refuse to gather our full strength our very existence will become impossible. From this day onwards, whatever it is we have to do, and whoever is doing it, there should be no more inefficient half-heartedness and no more spirit of fatalistic resignation.

—*(Courtesy of "Nature"*, 152, 1943, 118.)

MUSLIM BLOOD GROUPS WITH PARTICULAR REFERENCE TO THE U.P.

By D. N. MAJUMDAR

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RECENTLY blood groups of Muslims have been determined at Calcutta by Macfarlane, and Greval and Chandra. The former grouped 120 Muslims from Budge Budge (24 Parganas) and 136 urban Muslims from Calcutta, and the latter 321 mostly urban Muslims in connection with the blood transfusion service of Calcutta.

About 400 Muslim students at Lucknow have been grouped by me. The denomination Shia and Sunni were either given by the students or assigned by my Muslim colleagues. Doubtful cases were excluded. When two brothers were found to belong to the same group one of them was excluded from calculation.

The accompanying three tables give the blood groups of the Muslim students of the Lucknow University, representing the U.P. Muslims, and those of their co-religionists in other localities further east and west geographically.

TABLE I

Blood Groups of Muslims of the U.P.

	O	A	B	AB
Muslims (326) ..	34·1	23·0	33·7	9·2
Shia Muslims (106) ..	35·8	25·5	33·7	4·7
Sunni Muslims (220)	33·2	21·8	37·7	9·2

TABLE II

Blood Groups of Muslims and Their Gene Frequencies

	O+A	p	q	r	Author
(1) Turks	74·80	·256	·135	·607	Hirschfeld
(2) Arabs	72·00	·238	·151	·616	Altounyan
(3) Syrian Muslims ..	84·90	·252	·081	·669	Boyd and Boyd
(4) Tunis Muslims ..	78·88	·211	·112	·681	Caillou and Disdier
(5) Pathans	60·60	·209	·222	·541	Malone and Lahiri
(6) Hazaras	57·00	·157	·254	·566	do.
(7) U.P. Muslims ..	57·10	·177	·245	·584	Majumdar
(8) "Shias"	61·30	·165	·218	·598	do.
(9) "Sunnis"	55·00	·159	·259	·575	do.
(10) Budge Budge Mohamedans	51·60	·174	·282	·582	Macfarlane
(11) Urban Mohamedans ..	62·50	·200	·209	·572	do.
(12) Calcutta Mohamedans ..	54·10	·188	·264	·543	Greval and Chandra

TABLE III

Blood Groups (contd.)

	B+AB	O	A	B	AB	Author
(1) Turks (500)	25·20	36·80	38·00	18·60	6·60	Hirschfeld
(2) Syrian Arabs (1,149) ..	28·00	38·00	34·00	20·00	8·00	Altounyan
(3) Syrian Muslims (199) ..	15·10	44·70	40·20	11·60	3·50	Boyd and Boyd
(4) Tunis Mohamedans (500) ..	21·20	46·40	32·40	15·80	5·40	Caillou and Disdier
(5) Pathans (150) .. → ..	39·40	29·30	31·30	33·30	6·10	Malone and Lahiri
(6) Hazaras (100)	43·00	32·00	25·00	39·00	4·00	do.
(7) U.P. Muslims (326) ..	42·90	34·10	23·00	33·70	9·20	Majumdar
(8) "Shias" (106)	38·70	35·80	25·50	34·00	4·70	do.
(9) "Sunnis" (200)	46·90	33·20	21·80	37·70	9·20	do.
(10) Budge Budge Mohamedans (120)	48·30	28·30	23·30	40·00	8·30	Macfarlane
(11) Urban Mohamedans (136) ..	37·50	33·10	29·40	30·90	6·60	do.
(12) Calcutta Mohamedans (321)	45·70	29·50	24·60	36·40	9·30	Greval and Chandra

Tables I, II and III do not need any explanation. A casual inspection of these figures will show how far the Muslims of India serologically stand with respect to their colleagues in other parts. The Muslims of Budge Budge (24 Pargs., Bengal) and of all Bengal (Greval and Chandra) show difference from the U.P. Muslims, both the Shias and Sunnis, the former being more remote than the latter. As we proceed from Western India to the east, the O percentage decreases from 35·80 (Shias) to 29·50 (all Bengal: Greval and Chandra), while the percentage of B increases from 33 to 40 in the case of the Muslims of Budge Budge. If we add B + AB, the Sunnis of U.P. (46·90) stand nearer to the Mohammedans of Budge Budge (48·30) as well as to those from all Bengal (45·70) though in the absence of details about distribution of the latter we do not know how far they are representative of Bengal Muslims. The Pathans, Shias and the Hazaras do not show even 40 per cent. B + AB.

The Muslims of Bengal and the depressed castes of the same area, show similar blood groups percentage (Macfarlane). The latter comprise Pod, Bagdi, Namo, Mal and Rajvanshi (75) showing 29·3 O, 22·7 A, 42·7 B and 5·3 AB. Again Macfarlane's non-caste Hindus, comprising the artisan and depressed groups (320), recorded 30·9 O, 22·2 A, 40·0 B and 6·9 AB. The large percentage of O among the Muslims of U.P. and a lower incidence of B show perhaps a higher degree of isolation or ethnic purity of the upcountry Muslims. This is corroborated by the percentage distribution of blood groups among the urban Muslims (Macfarlane) who belong to Bengal as well as to upcountry centres, more to the latter, I suppose. Again the low value for B among the Muslim population outside India and also very high incidence of A distinguish these from Indian Muslims. A critical study of the data along with those now being collected will be presented in a separate paper to be published elsewhere.

I am indebted to the authorities of the Shia Intermediate College, Christian College, Isabella Thoburn College for Girls, and Canning College.

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SUBSTITUTES IN WAR AND PEACE

ACCORDING to *Nature*, 1943, 152, 184, Doctor C. H. Desch, in a brochure entitled "Substitute materials in war and peace", invites attention to some of the less well-known facts: In the autumn of 1941, Germany was using producer-gas for running 150,000 lorries; many more were on order and also 20,000 new agricultural tractors with the same means of propulsion. In the United States, synthetic resins have become even scarcer than the aluminium they were designed to replace. An artificial fibre, made entirely from coal, limestone and chlorine, has been made in Germany since 1939; it is used for protective clothing, fishing nets and chemical filters. Some 10,000 tons of 'fodder yeast', first made on a large scale in Germany during 1914-18, was being produced at Regensburg in 1939. Nickel in the Axis countries has been largely replaced by chromium and molybdenum, obtained within occupied regions. There is no evidence that the quality of German aircraft is suffering in any way from lack of suitable alloy steels, but for steel-making there is probably a shortage of manganese, for which no satisfactory substitute is known.

In Great Britain much economy has been effected by reducing the number of steel specifications from 2,000-3,000 to 85, and further reduction is possible. Copper and 'stainless' steel for making resistant chemical plant have been economized by using mild steel with a surface-layer of the more valuable metal, rolled on to it during the manufacture of the plates. Difficulties have been encountered in finding a satisfactory substitute for tin in making tin-plate and for bearings. In the United States, plants are being constructed to produce annually 800,000 tons of synthetic rubber from petrol and 200,000 tons from alcohol, prepared from grain. Japan is said to be using her superabundance of rubber by distilling it to produce petrol. Of all substitutes now in use, synthetic resins are considered to have the greatest probability of a survival, and as mineral resources gradually decline, as they inevitably must, greater use will be made of substitutes, and particularly of those which can be produced from the renewable raw materials provided by Nature.

LETTERS TO THE EDITOR

OXIDATION BY $KHSO_4$ AS A DISTINGUISHING FEATURE BETWEEN AMPHIBOLES AND PYROXENES

In the course of my investigations, while fusing a Cummingtonite (an iron amphibole) with $KHSO_4$, I observed that the mineral got very black and, on examination, this was found to be accompanied by the oxidation of a considerable proportion of its FeO into Fe_2O_3. On fusing with $KHSO_4$ a pyroxene, more or less similar in composition to the amphibole referred to above, it was found that oxidation of its FeO had taken place, but markedly to a less extent. To ascertain the implications of this difference in the degree of oxidation between amphiboles and pyroxenes, a few more pairs of these two classes of minerals, each pair more or less corresponding in composition, were fused with $KHSO_4$; and, from the

TABLE OF RESULTS

Sl. No.	Sample Nos.	Amphibole or Pyroxene	Constituents in the sample FeO%	Constituents in the sample MgO%	FeO% after $KHSO_4$ treatment	FeO% of col. (*f*) calculated as percentages of FeO% col. (*d*)
a	*b*	*c*	*d*	*e*	*f*	*g*
1	Z_3/488	Amphibole (Cummingtonite)	39·16	4·65	2·46	6·28
2	M_2/845	Pyroxene (Hypersthene)	38·65	7·57	21·65	56·01
3	R/239	Amphibole (Cummingtonite)	22·23	16·41	14·15	63·65
4	M_2/803	Pyroxene (Hypersthene)	18·42	22·59	18·22	98·91
5	H_9/217	Pyroxene (Hypersthene)	31·71	13·00	25·41	80·13
6	M_2/753	Pyroxene (Hypersthene)	30·15	9·36	18·53	61·48
7	M_2/873	Amphibole (Cummingtonite)	34·29	9·67	2·30	6·71
8	K/868	Amphibole (Hornblende)	13·11	10·36	6·36	48·51
9	Nil	Amphibole	26·57	15·31	7·85	29·54
10	Nil	Amphibole	7·64	10·80	0·59	7·72
11	L/223	Pyroxene	41·14	7·14	21·86	53·14

results obtained so far, as shown in the following tabular statement, it is evident that the proportion of the FeO oxidised to Fe_2O_3 in amphiboles is decidedly and considerably higher than in the pyroxenes of similar composition.

In the table above, in all the samples, only the FeO and MgO values are given, as these are the important constituents besides SiO_2. But sample No. 8 contains also 12·76 per cent. CaO and 10·15 per cent. Al_2O_3, and No. 10, 15·07 per cent. Fe_2O_3 and 6·90 per cent. Na_2O.

The degree of this oxidation may be modified to some extent by the other oxides present in the mineral like MgO, CaO, etc. The presence of a high proportion of MgO lowers the degree of oxidation as may be seen by comparing the analytical results of amphiboles, Nos. 1, 3, 7 and 9; and of pyroxenes, Nos. 2, 4, 5, 6 and 11. In pyroxene No. 4, where the proportion of MgO to FeO is high, the oxidation is very little. But, in amphiboles, Nos. 8 and 10, though the proportion of MgO to FeO is high, yet the degree of oxidation is large. This may be due to the influence of considerable amounts of Al_2O_3 and CaO present in No. 8, and of Na_2O and Fe_2O_3 present in No. 10. The fusions, in all cases, were carried out at about the same temperature, for the same period of time and using powders of about the same fineness.

The relative difference between the amphiboles and pyroxenes in the degree of oxidation of their FeO seems to be dependent upon their crystal structure. Further investigations are in progress and the results will be published in detail elsewhere.

M. R. Ananthanarayana Iyer.
Mysore Geological Dept.,
Bangalore,
August 30, 1943.

THE IODINE CONTENT OF THE THYROID GLANDS OF SOUTH INDIAN ANIMALS

During the course of our investigations (1941-1942) on the preparation of thyroid extracts, under the auspices of the Board of Scientific and Industrial Research, the remarkable observation was made that the desiccated thyroid prepared from the local animals was much higher in iodine content than the continental specimens. These observations, which were published as a brief note in the *Review of the Technical Work of the Board of Scientific and Industrial Research*,[1] have now been independently confirmed by Dr. Mukerji,[2] of the Biochemical Standardisation Laboratory, who has found that the thyroxine iodine contents of desiccated samples prepared in India are, as a rule, higher than those of foreign specimens.

The values that we obtained for the Total and Thyroxine Iodine contents of desiccated thyroids of cattle, sheep and pig, analysed by standard methods,[3] are given in the following table (No. I), the experiments being carried out with South Indian animals exclusively:—

Table I

Chemical Assay of Desiccated Thyroid (Per cent. by weight of desiccated gland)

	Total Iodine	Thyroxine Iodine
Beef thyroid .	0·91	0·35
Sheep thyroid ..	0·66	0·26
Pig thyroid ..	0·84	0·39

The average weights of the thyroid as well as of other glands like adrenal and pituitary of Indian animals are definitely smaller than those of the corresponding glands of European and American animals. In the case of the thyroid glands, however, the total iodine content is considerably higher, amounting to as much as 0·91 per cent. for beef glands. Kendall, who first isolated thyroxine in a pure and crystalline condition, worked with desiccated hog glands, the total iodine content of which was as low as 0·21-0·34 per cent.[4] and Harington made use of desiccated thyroid having an iodine content of 0·5 per cent.[5] for his classical researches on the isolation and study of the chemistry of thyroxine. It is also a well-known fact that several specimens of American thyroid are so low in iodine, that they cannot conform to the B.P. standard, which insists on having a thyroxine iodine content of 0·1 per cent.

It is generally agreed that the amount of iodine in the thyroid gland is dependent on the iodine content of the diet. The high iodine content of the thyroids of the South Indian animals must, therefore, be attributed to the high level of iodine in drinking water and in the vegetable kingdom here. It is also in conformity with the striking fact that endemic goitrous regions are practically unknown in South India.

This research scheme was financed entirely by the Board of Scientific and Industrial Research, to whom our grateful thanks are due.

Chemistry Department, Presidency College, Madras.
September 1, 1943.
B. B. Dey.
P. S. Krishnan.
M. Giriraj.

1. *Curr. Sci.*, 1942, **11**, 171. 2. Mukerji, *Curr. Sci.*, 1943, **12**, 256. 3. *British Pharmacopœa*, 1932 and *Addendum*, 1936. 4. Kendall, *Thyroxine*, 1929. 5. Harington, *The Thyroid Gland*, 1933.

CHEMICAL INVESTIGATION OF SEED OIL OF *MORINGA CONCANENSIS*

Moringa concanensis (Gujarati: "Kadavo Sargavo") is a medium type of tree glabrous except the young parts and the inflorescence and grows almost everywhere in Gujarat. The tree bears fruits in the form of capsules which are straight, acutely constricted between the seeds on an average 1 to 1½ ft. long. Each capsule contains several seeds. These seeds are white or pale yellow.[1] These seeds on

extraction with ether give on an average 38 per cent. of yellowish coloured oil. The oil, besides its use in medicine, can very well be used to lubricate delicate machinery. On finding that these types of trees are abundant on this side and the oil available would also be abundant, and in view of the above uses, it was thought advisable to carry out the chemical investigation of the same oil.

The oil has a faint pleasant odour and shows the following characteristics:—

Refractive index at 40° C. = 1·4624.
Acid value (in terms of oleic acid) = 2·61.
Saponification value = 189·3.
Iodine value (Wij's method) = 79·25.
R.M. value = 0·57.
P. value = 0·26.
Acetyl value = 23·1.
Unsaponifiable matter = 1·095.

The examination of the component fatty acids of the oil is in progress.

Industrial Chemist's Laboratory,
Baroda, C. B. PATEL.
September 4, 1943.

1. *The Flora of the Presidency of Bombay*, **1**, Part 2, 283; and *Watt's Dictionary Econ. Prod.*, **5**, 275.

VARIATION IN THE MEASURABLE CHARACTERS OF COTTON FIBRES: A NOTE ON THE VARIATION BETWEEN FIRST AND SECOND FLUSH OF BOLLS

IN the Coimbatore tract the normal pickings of cotton end by April. If, however, showers of rain fall in time a second flush of flowers is produced which gives a supplementary picking somewhere in June. It was thought interesting to compare the fibre properties of the pickings made from the two flushes. Seven strains of *G. hirsutum* which were grown at the Cotton Breeding Station, Coimbatore, were utilised for this enquiry. It should be mentioned that in the normal pickings, the quantity of good *kapas* was a large percentage of the total. In the summer picking, however, it formed about a fifth or a fourth of the whole. For the study of the properties only the good *kapas* from the bulk was utilised. The results obtained are given in Table I.

TABLE I
Results (Mean of 7 Values)

Property	Normal	Summer	Difference Normal-Summer
Seed weight (mgm.)	107·4	99·3	+ 8·1
Lint weight (mgm.)	63·1	45·1	+18·0
Ginning percentage	37·0	31·2	+ 5·8
Mean length (inch)	0·924	0·844	+ 0·080
Fibre weight per cm. (10^{-6} gm.)	1·483	1·323	+ 0·160
Standard fibre weight (10^{-6} gm.)	1·753	1·570	+ 0·183
No. of fibres per seed (1000's)	18·39	16·[illegible]0	+ 1·99
Mature fibres %	56·29	57·43	− 1·14
Immature fibres %	16·00	17·59	− 1·59

It will be seen that the seed weight is higher for the normal picking by 8·1 mgm. on the average which is highly significant. The lint weight and ginning percentage are similarly higher by 18·0 mgm. and 5·8 per cent. respectively. The mean fibre length and the number of fibres per seed are significantly higher for the normal picking by 0·080" and 1,990 respectively. The fibre weight per cm. as well as the standard fibre weight are similarly higher by 0·160 and 0·183 units respectively. The difference in the maturity, however, is not significant.

It will be seen that on the whole the summer picking exhibits considerable deterioration, excepting in fineness and maturity, as compared with the normal picking. This result, it will be recalled, is for the good *kapas* only which forms about a fourth or fifth of the whole picking. Even this good portion shows such a deterioration; the quality of the whole picking should be considerably worse indeed.

The cause for the deterioration noted above appears to be, besides the later age of the plant, the severe attack of insect pests. The reduction in the number of fibres per seed and the standard fibre weight appears to be due probably to the higher temperature under which the fibres are produced, as is shown in another place.*

Cotton Breeding Station,
Coimbatore, R. L. N. IYENGAR.
September 1, 1943.

* Iyengar, R. L. N., *I.C.C.C.*, Second Conference, *Report*, 1941, 145-46.

A CASE OF CHLOROPHYLL DEFICIENCY IN SAFFLOWER (*CARTHAMUS TINCTORIUS* L.)

IN the year 1938-39, in the progeny of a plant of I.P. 7 Safflower, 19 plants, out of a total of 98, were observed in which, although the cotyledonary leaves were normal green, the true leaves were chlorophyll-deficient. The chlorophyll deficiency increased gradually from the first true leaf up to the third or fourth leaf. Thereafter the next few leaves were practically white and very much reduced in size. At this stage these plants died.

The ratio of normal green to chlorophyll-deficient plants, as could be seen from the frequencies (79 : 19), was 3 : 1, suggesting that the parent-plant was heterozygous for the gene pair governing chlorophyll deficiency; this heterozygous condition may have resulted from the mutation of one of the dominant alleles of the pair responsible for the normal green condition, to the recessive state.

In order to test the validity of this assumption, the seeds of six normal green plants, picked at random, were harvested and sown separately in the following year (1939-40). Of the six progenies five segregated in a 3 normal green : 1 chlorophyll-deficient plants and one bred true to the normal green condition. Theoretically, four progenies should have segregated and two bred true to green on the basis that the chlorophyll-deficient condition is a simple recessive to the green. The

frrquencies for the individual aggregating cultures are given below:—

TABLE I

Cult. No.	Frequencies		Total	Dev. / S.E.
	Normal green	Chlorophyll deficient		
1	65 (60·75)*	16 (20·25)	81	1·09
2	66 (61·50)	16 (20·50)	82	1·15
3	Bred true for the normal green condition			
4	49 (43·50)	9 (14·50)	58	1·65
5	48 (45·00)	12 (15·00)	60	0·89
6	44 (40·50)	10 (13·50)	54	1·10
Total	272 (251·25)	63 (83·75)	335	2·62

* The figures in brackets represent expected frequencies.

Although in each case the fit to a 3 : 1 ratio is good, the fit for the total of all the segregating cultures is bad. This is due to the fact that there is a deficiency in the recessive class in all the segregating families and this deficiency has an accumulated effect in the total.

In order to find out whether it was merely due to chance that all the segregating families were deficient in the recessive class or whether it was due to some genetical or other causes, sowings were repeated with a known number of seeds from each of the above cultures. The data which are reproduced here show that the deficiency of the recessive class in all the segregating families in the initial sowing was merely due to chance.

TABLE II

Cult. No.	Frequencies		Total	Dev. / S.E.
	Normal green	Chlorophyll dificient		
1	66 (55·50)	8 (18·50)	74	2·82
2	41 (39·00)	11 (13·00)	52	0·64
4	37 (34·50)	9 (11·50)	46	0·87
5	29 (30·00)	11 (10·00)	40	0·36
6	35 (36·00)	13 (12·00)	48	0·33

These results, therefore, indicate that this type of chlorophyll deficiency in safflower is inherited on a monofactorial basis, the chlorophyll-deficient condition being recessive. Further, this condition appears to have arisen as a result of gene mutation and is perpetuated through plants heterozygous for this character.

Imperial Agricultural Research Institute, New Delhi,
R. B. DESHPANDE.
August 17, 1943.

FURTHER CHROMOSOME NUMBERS IN THE CÆSALPINIACEÆ

IN this note which is a continuation on the chromosome numbers of Cæsalpiniaceæ,[4,5] the author records the chromosome numbers of the following species as counted during meiosis in pollen mother-cells:—

Amherstia nobilis Wall.
Saraca indica Linn.
Brownea sp. (usually called *B. Hybrida* in the gardens)
} $n = 12$

1 2 3 4

FIG. 1–4

FIG. 1. *Amherstia nobilis*, I metaphase. FIG. 2. The same, II metaphase. FIG. 3. *Brownea hybrida*, I metaphase. FIG. 4. *Saraca indica*, II metaphase.

This number agrees with that reported previously for the genus *Cæsalpinia*,[2,5,7] *Cersis canadensis*,[7] *Cassia fistula*,[8] *C. sophora*,[3] *C. alata*[7] and *C. tomentosa*.[1,6]

The material for this study was obtained from plants cultivated in the Royal Botanic Garden, Calcutta. The author is obliged to the authorities of this Garden for providing all facilities for collection, and to Dr. A. C. Joshi for his help.

Maharaja's College, Vizianagram,
J. V. PANTULU.
September 1, 1943.

1. Hus, H., *Proc. Calif. Acad. Sci.*, 1904, III Ser., **2**, 329. 2. Jacob, K. T., *Ann. Bot.*, *N.S.*, 1940, **4**, 201. 3. Kawakami, J., *Bot. Mag. Tokyo*, 1930, **44**, 319. 4. Pantulu, J. V., *Curr. Sci.*, 1940, **9**, 416. 5. —, *Ibid.*, 1942, **11**, 152. 6. Saxton, W. T., *Trans. S. Africa Phil. Soc.*, 1907, **18**, 1. 7. Senn, H. A., *Bibliog. Genet.*, 1938, **12**, 175. 8. Tischler, G., "*Allgemeine Pflanzenkaryologie*, Bd. 2, Abt. 1, Teil. 1, 1921-22.

BAICALEIN FROM THE SEEDS OF *OROXYLUM INDICUM* VENT.

DURING the investigation of the seed-oil of *O. indicum* Vent.,[1] one of us (C.R.M.) reported the isolation of a yellow crystalline substance (m.p. 274°) in a quantity which was too small for further investigation.

This work has been continued, and on careful examination of various extracts, we have obtained another yellow crystalline substance (m.p. 265-66°) from the alcohol, acetone and water extracts. Its carbon and hydrogen values, its specific colour reactions and the study of the properties of its demethylation, methylation and acetylation products, which agree closely with those recorded for them in literature,[2,3] indicate it to be a trihydroxy flavone, $C_{15}H_{10}O_5$, $[C_{15}H_7O_2(OH)_3]$, *viz.*, 5 : 6 : 7-trihydroxy flavone or 'Baicalein'. We have further confirmed our conclusion that this substance is baicalein by means of a mixed melting point determination with an authentic sample of baicalein kindly supplied by Prof. Keita Shibata.

Baicalein was isolated from the roots of *Scutellaria* [illegible]*ensis* Georgi by Shibata, Iwata and N[illegible]ura,[2] and was synthesised by

Bargellini.[3] It is interesting to mention here that baicalein occurs along with Oroxylin-A in the root bark of *O. indicum* Vent.[4]

A detailed account of this investigation will shortly be published elsewhere.

Central Excise Laboratory,
The Technological Institute,
Baroda,
September 20, 1943.
C. R. Mehta.
T. P. Mehta.

1. Mehta, *Proc. Ind. Acad. Sci.*, 1939, **9A**, 390. 2. *Acta Phytochim.*, 1923, **1**, 105. 3. *Gazzetta*, 1919, **49**, ii, 47. 4. Shah, Mehta and Wheeler, *J.C.S.*, 1938, 1555.

INDIAN RHUBARB AS SUBSTITUTE FOR 'OFFICIAL' RHUBARB

Rheum officinale Baillon, *Rheum palmatum* Linné and other species and hybrids of Rheum, grown in *China and Tibet* are the recognised varieties of rhubarb in the British and the U.S. Pharmacopœias. *Rheum emodi* Wall., which grows in the Himalayas at altitudes of 4,000 to 12,000 feet, is commonly believed to be of an inferior grade to the Chinese and Tibetan drug and is not acceptable as a substitute in 'official' medicine.

On the basis of available chemical and pharmacological evidence of earlier workers, Chopra[1] suggested in 1933 that Indian rhubarb, if properly cultivated, could be accepted as an efficient substitute for foreign rhubarb. No systematic work is traceable since to support this statement.

During last year presumably on account of the difficulty of securing Chinese rhubarb, possibilities of a profitable export trade in Indian rhubarb have developed and repeated enquiries have been referred to this department with a view to utilising Indian rhubarb in official pharmacopœial preparations. A pharmacognostic, chemical and pharmacological investigation was, therefore, started with seven different varieties of Indian rhubarb obtained from localities such as Sikkim, Assam, Nepal, Kashmir, etc., and though the enquiry is still progressing, the following observations may be recorded.

1. Pharmacognostic Examination

(*a*) *Comparative Anatomical Structure.*—A study of the comparative anatomical structure of *R. palmatum* Linn., *R. officinale* Baill., and *R. emodi* Wall., shows that vascular bundles, xylem vessels, medullary rays and cell contents are more or less the same in all the three varieties except with minor variation. The distinguishing characters are total absence of star spots and presence of lignified xylem vessels in *R. emodi* Wall., *R. officinale* Baill., resembles more or less *R. palmatum* Linn. in botanical characteristics.

(*b*) *Comparative Characteristics of Rhubarb Powder.*—

Chinese Rhubarb	European Rhubarb	Indian Rhubarb
Colour—Brownish Yellow	Bright yellow	Brownish yellow
Odour—Faint	Very faint	Fragrant
Characteristic features—Numerous calcium oxalate crystals, starch abundant, vessels non-lignified	Same as in Chinese rhubarb	Numerous calcium oxalate crystals, starch abundant, vessels lignified

2. Chemical Examination

Official Rhubarb—

(*a*) *Alcohol* (45 p.c.)—soluble extractive—not less than 35 p.c.
(*b*) Other organic matter—not more than 2 p.c.
(*c*) Acid-insoluble ash—not more than 1 p.c.
(*d*) Emodin and chrysophanic acid—present.

Indian Rhubarb—

(*a*) Average—35·5 p.c.
(*b*) Slightly more than 2 p.c.
(*c*) From 0·6 to 1 p.c.
(*d*) Present.

3. Pharmacological Examination

Equivalent weights of the dry powder of an official variety of rhubarb and an Indian variety of rhubarb (with more or less similar analytical data) were administered to cats by stomach tube and their purgative effects observed. The method employed was too crude to enable a comparative quantitative evaluation possible but in general it may be stated that the Indian variety showed a satisfactory purgative effect.

Further data are being gathered for a detailed report elsewhere but the evidence points to the fact that at least certain varieties of Indian rhubarb* (cultivated variety as distinguished from the wildly growing species) may also be recognised in the Pharmacopœias for medicinal use provided they conform to the specifications laid down in the B.P. and/or U.S.P. The darker colour, coarser texture and minor differences in pharmacognostic characteristics of the Indian rhubarb need not necessarily mean that it is inferior in its content of therapeutically-active principles.

In this combined study, help was received from Mr. A. B. Bose (Pharmacognostic study), Messrs. G. K. Roy and R. C. Guha (Chemical study) and Dr. N. K. Dutt (Pharmacological study).

Specimens of powedered rhubarb ('official' varieties) were obtained through the courtesy of Mr. J. K. Lahiri of the Department of Chemistry, School of Tropical Medicine.

Bio-Chemical Standardisation
Laboratory, Govt. of India,
Calcutta/Kasauli,
August 16, 1943.
B. Mukerji.

* Two varieties of Indian Rhubarb have been found *not to conform to B.P.* specifications. Attempt is being made to identify these varieties.

1. Chopra, *Indigenous Drugs of India*, 1933, p. 235, Art Press, Calcutta.

PRELIMINARY NOTE ON THE PERFECT STAGE OF *EPHELIS ORYZAE* SYD. [*BALANSIA ORYZAE* (SYD.) COMB. NOV.]

Ephelis Oryzæ Syd. is a well-known parasite in the paddy-growing regions of South India, sometimes causing heavy damage. The type material on the basis of which Sydow erected the species *E. Oryzæ* was collected by McRae near Telungupalayam, Madras Presidency. The disease manifests itself in the inflorescence, where in the place of normal healthy grains, a gelatinous mass of spores which dries up into a greyish-white horny crust, is observed. In many cases the inflorescence fails to emerge out of the boot due to severe infection. The conidiospores are formed within the pycnidia differentiated from the mycelium. As development proceeds, the entire endosperm is destroyed, leaving a black hyphal mass covered by the persistent glumes. The conidiospores are acicular measuring $22\text{-}38 \times 1\ \mu$.

After the dispersal of the conidiospores, the grains become shrivelled up and spongy in texture. Some of these grains were collected, washed in sterile distilled water thoroughly, and placed in petri dishes containing moist silver sand, previously sterilized. Small bits of the material were often tested to study further developmental stages.

The formation of perfect stage was observed in many of the grains after 30 to 45 days. From the mycelium a clavate stipe measuring up to 0·5 mm. in length, cinnamon yellow in colour, with a sphæridium, was formed

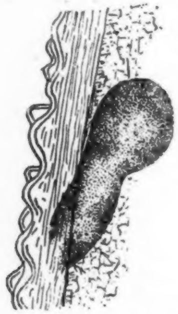

FIG. 1. Stipitate stroma with the spheridium × 200.

(Fig. 1). The stromata could be made out when the enveloping glumes were dissected out. Perithecia were ovate to cylindric and immature. The lack of true sclerotia and other characters clearly indicate that the fungus is a species of *Balansia*. It essentially differs with regard to conidiospore measurements and other characters, from other species of *Balansia* so far recorded. The perfect stage having been observed, a new combination *Balansia Oryzæ* (Syd.) Narasimhan *et* Thirumalachar is proposed. A formal description of the species will be published separately.

Instances of the discovery of *Balansia* stage of species of *Ephelis* are known. Weber[2] for instance collected overwintering sclerotia of *Ephelis mexicana* which, on germination, developed stromata as in *Balansia hypoxylon*. Sydow[1] who recorded *Balansia Andropogonis* on *Andropogon aciculata* from India, stated that *Ephelis palladia* Pat. common in Tonkin and the Philippines, is doubtless the conidial stage.

Bangalore, M. J. NARASIMHAN.
September 9, 1943. M. J. THIRUMALACHAR.

1. Sydow, H., and P., and Butler, E. J., *Ann. Mycol.*, 1911, **9**, 395. 2. Weber, G. F., *Phytopathology*, 1924, **14**.

ON THE EXTERNAL MORPHOLOGY OF THE LARVA OF THE GLOW-WORM, *DIAPHANES* SP. (LAMPY: COL.)

THE following description is prepared from a collection sent to me in February 1942 from Pampadampara Estate, S. India. I am deeply thankful to J. C. M. Gardner, Forest Entomologist, Dehra Dun, for helping me in identifying the larvæ. The collection consisted of only two larvæ besides males and so far as I know a detailed account of the external morphology of this form is not available. In fact, our present knowledge of Lampyridæ is very meagre and the larvæ as well as females of several species remain still undescribed.

Length—About 40 mm.
Colour—Dark brown.

Tergal plates are distinct, rugose and mid-dorsally sulcate, sulcations being feeble in the last two plates.

Head is black, prognathous, depressed and completely retractile into the prothorax. Head-capsule is incomplete beneath, where it leaves a gap in which is placed the labiomaxillary plate. The Y-shaped epicranial suture is impressed dorsally and represented internally by strong ridges. The eyes are anterior and lateral, immediately behind the antennæ, which are retractile into the extensive antacoria. Antenna is 3-jointed, apical joint being very small and papilla-like while the sub-apical as well as basal are long with few tactile setæ. The basal joint is very long and almost retracted into the head. Anterior margin of the head-capsule is continued beyond the antennal base and it gives off on each side a rounded process which probably represents the precoila which exactly fits into a slight concave depression or preartis on the dorsal aspect of the base of the mandible. The precoila of each side bears a very conspicuous long spine. Another very long spine springs from immediately behind each antenna. Clypeus is deeply and widely foveate medially. Ventrally the gena of the head-capsule is produced anteriorly into a genal process, the postcoila, whose apical surface bears an acetabulum which receives the condylar postartis of the mandible. The genal process runs anteriorly and inwards, its outer margin forming the ventral border for the antennal base. Dorsally the base of the antenna is bordered by the margin of the precoila. The mandible is strongly falcate with the basal half broad and flattened inwards. The broad basal area of the mandible is

produced anteriorly into another strongly falcate secondary tooth, the retinaculum. The mandible is pierced by a long canal whose external opening is sub-terminal and internal opening placed at the base just internal to the pre-articular acetabulum. Ventrally just outside the internal opening of the mandibular canal is the rounded post-articular condyle which articulates with the genal acetabulum. The inner border of the mandibular base is beset with a very fine brush of hairs. There is also a large tuft of stiff hairs forming a conspicuous sheath at the base of the mandible. The mandible is finely pubescent on the ventral side. The labio-maxillary plate is formed by the median labium and the lateral maxillæ. The Cardo is small and sub-quadrate with the posterior and outer borders straight and the inner border slightly convex. The stipes is very large, stout, basally narrowed and carries distally the maxillary palp. The maxillary palp is 4-jointed, the basal joint being the longest and almost as large as all the remaining joints put together. The second and third are very narrow while the apical is least chitinised, strongly compressed and bears a sensory streak. All the joints carry setæ, some of which are very long. Each stipes bears ventrally four long spines. Just on the inner side of each maxillary palp is the two-jointed galea, whose stout basal joint bears a long ventral supporting process and the small apical joint carries a very long spine. Lacinia is in the form of a brush supported by sclerites and presents a sharp cutting tooth for the animal. It is placed dorsally and both face each other. On the inner side it is supported by a triangular sclerite whose apex is attached to the inner border of the stipes. Dorsally it is supported by a broad sclerite whose anterior end is pointed, posterior and inner margins convex and outer margin concave. The narrow labium is differentiated anteriorly into a prelabium which carries the two palpigers bearing the labial palpi. Each labial palp is 2-jointed, the distal joint being narrow, slender and tactile. Dorsally the prelabium carries a white brush formed of fine bristles. The post-labium is formed of a single elongate flask-shaped sclerite which represents probably the fused mentum and sub-mentum. The dilated basal region of the sclerite carries two long symmetrically placed spines.

Thorax.—Pronotum is longer than broad, anteriorly narrowed and anterolateral margins rounded. The median longitudinal sulcus terminates anteriorly in a very slight notch. Lateral margins are straight and the disc is raised medially and strongly punctate. The posterolateral angles are tipped with yellow. The lateral margin is raised into a *marginal carina.* The area between the disc and marginal carina is depressed. The mesonotum is nearly as long as broad and sub-quadrate with a *lateral carina* on either side of the disc. Lateral margins are sub-parallel. The median longitudinal sulcus is present. The anterior notch is conspicuous. Posterolateral angles are tipped with yellow. The metanotum is slightly broader than long and sub-quadrate with both lateral and marginal carinæ. Anterior notch is well formed and posterior border convex. There are three pairs of thoracic legs. Coxa is black, long and cylindrical. Trochanter is large and very feebly constricted. The coxo-trochanteral joint is distinctly dicondylic and conspicuously creamy white. Distal half of the trochanter is brownish and setose. Femur is long and cylindrical and carries ventrally a median light brown line which is continuous with a similar line on the distal half of the trochanter as well. On either side of this line is a row of spines, which are longer and stouter and more on the distal half than on the basal. The tibiotarsus is slightly shorter than femur and carries on the inner surface a profuse growth of very long and strong spines. The femur and tibiotarsus are black except at the femoro-tibio tarsal joint which is creamy white. The tibiotarsus is narrowed distally into a pale rufous area which bears a strong single claw. At the base of the claw is another pair of small lateral claws. Both coxa and femur carry on their outer surface a faint longitudinal streak.

Abdomen.—The tergal plates are distinct, rugose and mid-dorsally sulcate, sulcations being feeble in the last two plates. There are nine visible abdominal terga. The abdominal terga 1-7 are all broader than long, anteriorly narrowed, posterior margin more or less convex, posterolateral angles tipped with yellow and longitudinally sulcate. The lateral carinæ are broken up into irregular pits and elevations. Eighth tergum is without the disc and lateral carinæ. Median sulcus is feeble, lateral margins yellow and the anterior and posterior border slightly concave. Ninth tergum is strongly concave posteriorly and the median sulcus is feeble. The lateral carinæ are absent but the posterolateral angles are sharply pointed and each carries a cluster of about five pale rufous flexible pointed spines. The sternal plates are devoid of the movable sternal spines so abundant in *Lamprophorus* larvæ. The abdominal sterna are provided with a row of from four to eight pale reddish brown spots on each side. These spots vary considerably in number and arrangement as evident from the following table:—

Abdominal sterna	Larva I		Larva II	
	Right	Left	Right	Left
I	8	6	6	5
II	8	8	8	8
III	8	6	6	6
IV	6	6	6	5
V	6	7	7	7
VI	6	6	6	6
VII	6	7	4	6
VIII & IX		Indistinct		

A median ochreous basal streak is present in the abdominal sterna V to VIII. Eighth sternum is sub-triangular and bears two pairs of blunt processes, the outer posterolateral and the inner posterior which is smaller than the former. The ninth sternum is very narrow.

Typically four pairs of pleurites are present in each abdominal segment. A long narrow plate almost touching the tergum but separated from it by distinct suture, forms the dorsalmost plate. The second is small but more or less continuous with the spiracle bearing third plate. The spiracle is borne anteriorly but the posterior surface is studded with a cluster of about a dozen round spots. Ventral to the spiracular pleurite is another narrow strip close to the sternum. The eighth pair of spiracular pleurites are eburated and photogenic.

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August 10, 1943.

RIVER MEANDERING AND THE EARTH'S ROTATION

THE literature dealing with rivers is full of conflicting explanations of the origin of meanders in unrestricted natural rivers. Geologists and geomorphologists often explain the occurrence of the sinuosities and the associated phenomena in terms of the earth's rotation, which is well-known as Baer's Law or Coriolis' Effect.

If ω be the angular velocity of the earth's rotation and λ the latitude of the place, a water body with mean velocity U_m will be acted upon by a deviating force of magnitude $2\,\omega \sin \lambda\, \bar{U}_m$ per unit mass, which, it is quite easy to show, acts at right angles to the flow

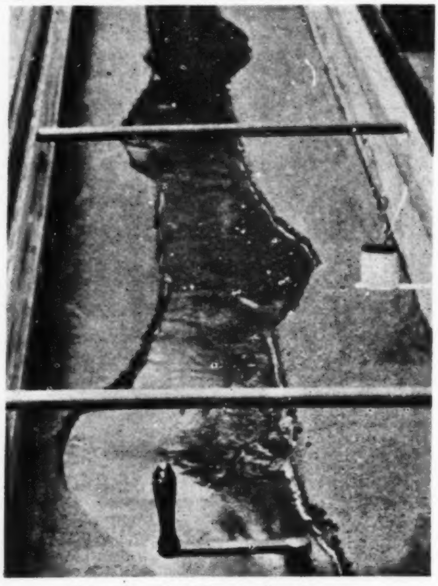

FIG. 1.—The Meandering Stream

direction and is to the right in the northern hemisphere and to the left in the southern hemisphere. And as the tendency of some of the rivers flowing in the two respective hemispheres is towards developing curves in the above sense, it is argued that the earth's rotation is the cause of river meandering.

However carefully conducted experiments by the writer at the Hydraulics Laboratory of the Imperial College of Science and Technology, London, show that the predominance of curves on the left or the right is merely a chance phenomenon, having hardly anything to do with the terrestrial rotation.

Fig. 1 is the photograph of a stream with well-developed curves situated alternately to the left and the right and the water is seen flowing smoothly through it. The channel had initially been moulded straight in an incoherent sand of mean grain diameter 0·70 mm., with the mean velocity equal to about 30 cm./sec., the sediment to water discharge ratio equal to about 1 : 700 and the width to depth ratio of the order of 20·0.

Before the bights arose, the stream bed changed into skew shoals such as are illustrated in Fig. 2, where the arrows depict the direction and the manner of motion of the sediment

← Direction of Flow

FIG. 2.—Illustrating the Skew Shoals

particles. Observations showed the particle paths to be inclined at an angle of from 45° to 60° to the main flow direction. So, transversely, a drag varying between 1 and 1·732 times the drag in the flow direction, must have acted upon the particles.

Taking $\lambda = 51°\ 31{\cdot}1'$ (value for the University of London), we find that a unit mass of water under the influence of the deviating force will describe a circular path whose radius of curvature is $2{\cdot}626 \times 10^5$ cm. So there will be a transverse gradient roughly equal to 1 : 300,000. The drag arising out of this is, however, seen to be quite trivial compared with even 50 gm./m.^{2} required for general motion of the particles in the flow direction.[1]

To increase the effect, a channel with transverse slope 3,000 as great, *i.e.*, 1 : 100, but with less slope and less sediment to discharge ratio, was run for about four hours. It failed to produce skew shoals or even any regular bights.

So, if the model experiments are any clue to large-scale phenomena, which ought to be the case, the conclusion is strongly against the terrestrial rotation being taken as the cause of river meandering.

Jamnadas Dewanmal Road,
Ratan Talao,
Karachi, MOHD. SALEH QURAISHY.
August 10, 1943.

1. Quraishy, M. S., *J. Univ. Bomb. Phys. Sci. No.*, Nov. 1943 (being published).

VIRUS DISEASES OF POTATOES IN INDIA

WHEN intensive investigations on breeding better potato varieties for India were taken up in 1935, it was realised that little improvement was possible if the manifold fungal, bacterial and virus diseases which affect this crop, were not taken into account from the very outset. This was particularly true of virus diseases which cause more permanent damage than others and lead to the rapid degeneration of varieties.

In 1935 a preliminary survey, both in the hills and the plains, was made and tubers collected from plants which appeared to be diseased by virus. Judging by symptomatology alone, ten types were separated, but the progenies of selected diseased plants gave rise in many cases to different symptoms and in others to healthy plants. As an insect-proof house necessary for such work was not available other arrangements had to be made for the identification of at least the more important virus diseases present in the plains of India where the problem is very acute. An opportunity for obtaining such co-operation of the Potato Virus Research Station, Cambridge, presented itself in 1938 when Dr. R. N. Salaman, F.R.S., kindly agreed to identify them if tubers from diseased plants were sent to him to Cambridge. Tubers from seven apparently "mosaic-diseased" plants of the Phulwa variety were sent in 1938 and another lot of 25 samples in 1939.

Unfortunately, the second and more important lot of samples got accidentally destroyed but from an examination of the first set, Dr. Salaman concluded that they were suffering from a chronic infection with Y virus (*Solanum* virus 2), which was confirmed by inoculation to tobacco, *Datura* and *Capsicum*, the latter two giving negative results.

Phulwa (= Patna White) is an important commercial variety cultivated in the plains, possessing good keeping qualities and relative freedom from disease, though in parts of the U.P., it gets severely attacked by this virus. Symptoms of affected plants are given below:

Plants dwarfed; leaves much reduced, distorted and wrinkled; leaflets cupped upward, rarely downward, owing to growth ceasing at edges but continuing in the middle; margins wavy, uneven; mottling veinal and intraveinal, covering large areas or entire leaflets, except midrib which remains green throughout; reddish pigment in all leaves at margin, spreading inwards; texture of leaf rendered medium hard but without necrotic spots or streaking. Yield and tuber size much reduced.

Potato virus Y is transmitted by the aphis *Myzus persicæ* (Sulz.) and by sap inoculation. It is inactivated at 52° C. and by the drying of the leaves, according to Holmes.[2] The use of virus-free seed tubers and careful roguing of diseased plants have given considerable success as will be evident from the results obtained at Delhi with commercial Phulwa 'seed' and tabulated below (Table I): —

TABLE I

Counts of diseased plants on three successive occasions at monthly intervals, first count being forty days after planting.

	First count		Second count		Third count	
	Total plants	Per cent. diseased	Total plants	Per cent. diseased	Total plants	Per cent. diseased
a	802	5·2	826	7·5	826	9·4
b	796	9·8	798	16·8	798	19·8
c	783	16·1	760	24·9	760	28·2

a = tubers from apparently healthy plants after roguing.
b = tubers from field where no roguing was done.
c = tubers from diseased plants.

TABLE II

Counts of diseased plants when planting was done on four different dates.

Planting date	Total plants	Per cent. diseased
Sept. 15 ..	339	31·3
Oct. 1 .	371	35·6
Oct. 15 .	470	4 9
Nov. 1 ..	200	7·3

The diseased plants in the first count were evidently due to tuber infection and show that roguing, even though done late in the previous season, is effective. The incidence of disease is considerably affected by the time of planting also, as will be manifest from data recorded in Table II.

It was noted that all tubers from an affected plant did not give diseased plants: When single plant progenies were grown separately, usually only 50 to 60 per cent. of the resulting plants showed disease. It may be added that this disease affects other commercial varieties also, similar symptoms having been observed in Darjeeling, Red Round, etc.

Apart from the above, the only other potato virus disease occurring in India, that has been definitely identified, is leaf-roll (*Solanum* virus 14). Its symptoms are highly characteristic and confirmation of its occurrence was obtained when material sent to Dr. Salaman for varietal identification was found to suffer from it.

Thanks are due to Dr. Salaman and to Dr. B. B. Mundkur for their help.

Imperial Agricultural Research Institute, New Delhi, B. P. PAL.
August 7, 1943.

1. Smith, Kenneth, M., *Plant Viruses: II. Tabulæ Biologicæ*, 1939, **17**, 60–66. 2. Holmes, F. O., *Handbook of Phytopathogenic Viruses*, Minneapolis, 1939.

REVIEWS

Social Studies and World Citizenship. By L. J. F. Brimble and F. J. May. (Macmillan & Co., Ltd., London), 1943. Pp. 158. Price 6 *sh*.

Not only teachers, but those parents who take more than superficial interest in the spiritual welfare of their children may profit by this wholesome and stimulating book, which aims at social unity and internationality. Adopting Canon Leeson's definition of citizenship as an activity of the personality to secure certain benefits for the community to which the citizen belongs, the authors proceed from the foundation of their thesis to guiding teachers in the application of history, geography, literature and science to a realisation of world citizenship by their pupils. For instance, of history they say that the most important attitude of mind to be gained from its study is the concept of progress through co-operation, and of the retrograde steps which follow aggression and self-seeking.

Geography they recognise as an effective discipline for promoting sympathetic understanding between individuals, and between different groups of individuals. Literature and science, like the arts, are already international, but this aspect of them can be further developed in the direction of biography; and in the case of music by radio. The book is refreshingly free from political bias, and from slogans. Here is no holiday from planning, but in so far as the authors are themselves planners, they seem to know that without goodwill the most elaborate plans are predestined to failure, whilst with goodwill the most artless may succeed. They know also that civic duty begins in the life of the family; and while claiming that the whole of our youth education should have a religious, as opposed to an agnostic background, they would base it on rational observation, not on emotional feelings and mythical beliefs.

Controversy is invited only when dealing with world citizenship in relation to the language problem. Accepting the desirability of an international auxiliary language, they agree with the British Association Committee of 1921 in condemning adoption of any national modern language because it would confer undue advantages and excite jealousy. To some, that might have the air of pandering to the very vice they seek to destroy—supernationalism; because, whatever the attractions of a synthetic language like esperanto may be, the fact remains that English is mother-tongue to more people than any other one language, and is already the second language of many millions more. For those who find the British people distasteful there are always the Americans in counterpoise, and the conventional whine about English spelling derives from a widespread misapprehension, namely, that you spell by memory. Actually, you spell mainly by observation: you know when a word "looks right" and correct it when it "looks wrong". For example, my reactions to the authors' "Leibniz" were (1) it looks wrong, and then (2) the common spelling is "Leibnitz": they did not begin with remembering the common spelling. Thus the habitually reviled English spelling is not so much a super-tax on memory as a vast gymnasium of observational exercise; and incidentally a mine of history.

M. O. F.

The Cathode-Ray Oscillograph in Industry.—By W. Wilson, D.SC., B.E., M.I.E.E. (Chapman and Hall, London), 1943. Pp. 160. 156 Figs. Price 12*sh*. 6*d*. net.

Of all the modern instruments which the experimental physicist created for his investigations none has found so extensive and increasing a use in almost all the branches of science and engineering as the Cathode-Ray Oscillograph either in its usual form or with some modifications. It has become an indispensable test instrument in electrical industries. Considering its importance, therefore, not many books have been published on it and the present volume written primarily for the industrial user forms a useful addition to their existing list.

The book consists of 12 chapters and one Appendix. Of these the first three are devoted to a general description of the assembly and a detailed description of its component parts and accessory circuits, their functions and alternative forms. The modern types of the Cathode-Ray equipments as available to the industry are then described at some length—particularly the Cossor and Du Mont sets in the glass tube variety and the Cambridge Oscillograph using a metal tube. Various kinds of tests and observations that can be carried out with these instruments are given with practical examples and records obtained from actual industrial applications in each case.

A chapter is devoted to a description of the electron microscope and the diffraction camera as they are cathode-ray tubes based on the same general principles but curiously one does not find any mention of the Iconoscope or allied tubes. The final chapter gives some constructional details with a view to help the worker carry out any minor repairs. General outlines of vacuum tubes, photoelectric cells and piezoelectric crystals are given in the Appendix.

The book is profusely illustrated with numerous photographic reproductions and neat circuit diagrams.

The treatment is rather concise for the standard of the average worker whom the author has kept in mind; and the worker may find it unclear at some places. Mathematics is avoided to make room for practical aspects.

This is not always an advantage for no amount of descriptive matter can have the unambiguous meaning of a mathematical statement.

On the whole the book will be found quite useful by workers in the electrical industries and by students who wish to be familiar with the practical uses to which the Cathode-Ray Oscillograph is put in industry.

N. B. BHATT.

Manometric Methods. By Malcolm Dixon. (Cambridge University Press, London), 1943. Second Edition. Pp. xiv + 155. Price 8/6.

It is a decade since the first edition of this book was written; during the period, this little book has inspired and guided successive batches of students of biochemistry in the adoption and experimentation of manometric technique which constitutes one of the most convenient, elegant, accurate, and widely practised methods of measurement in biochemical research.

Since the publication of the first edition, several refinements and improvements in the method have been effected; its applications have been extended. Micro and ultra-micro adaptations of the technique, capable of measuring volume changes of the order of one-millionth of a cubic centimetre, have been developed. The second edition, under review has been revised in the light of these developments.

Adequate recognition has not been given to Dr. Linderstrøm-Lang, who has been entirely responsible for developing the cartesian diver ultra-micrometer. From the volume one gains the impression that Dr. Linderstrøm-Lang was responsible only for the "suggestion"; it should, however, be added that the experimental technique and the applications of this ultra micro method were all thoroughly worked out at the Carlsberg laboratories in 1937 when the reviewer was working there.

The list of some further applications of manometric methods, the three appendices giving examples of standard experiments, and the table logarithms, add to the usefulness of the book.

The Application of Absorption Spectra in the Study of Vitamins, Hormones and Co-enzymes. By R. A. Morton. (Adam Hilger Ltd., London), 1942. Second Edition. Pp. 226. Price 28*sh*.

In a series of ten illuminating chapters, the author covers the entire field of vitamins, hormones, proteins, enzymes and co-enzymes in a broad and interesting manner suggestive of their inter-relationships. The first chapter gives a short account of the experimental assembly and the notations used in absorption spectrophotometry. References to literature where the technique of spectrophotometry is described at greater length, are given at the end of the chapter.

The second chapter is devoted to a consideration of the steroids including the closely allied antirachitic vitamins and sex hormones. Those interested in gaining an insight into absorption spectra in relation to chemical structure, will find this chapter exceedingly interesting and valuable. The subject of vitamins of the D group is treated against its historical background; reference is made to the difficulties encountered and to the precautions necessary in carrying out a spectrographic assay of vitamin D in natural products. The author has incorporated a substantial amount of his own experience in this field.

The third, the fourth and the fifth chapters respectively deal with (1) Provitamins and Vitamin A, (2) Vitamin E and Antioxidants, and (3) Vitamin K. They constitute a succinct and stimulating review of the vitamins of the fat-soluble group; the part played by spectroscopy in the discovery and development of these vitamins is indicated. The discovery of vitamin A_2 is directly the outcome of spectrographic methods of analysis. Those interested in the assay of the carotenoids and vitamin A should carefully study the relevant portions of the third chapter wherein attention has been drawn to the wide variability in the biological utilisation of β-carotene. The author adds: "When the chemist analyses a given product for vitamin A or provitamin A, he aims at a precise determination of the actual amounts present, whereas the biochemist's animal assay is concerned with available vitamin A or carotene. If a large proportion of the total is nutritionally useless, as often happens, it may be necessary to change the method of preparing or cooking the food, or to alter the bulk composition of the diet so as to improve utilisation. In short, the problem of vitamin A nutrition has emerged from a phase of spurious clarity, resulting from over-simplification, into a very complex phase in which the main task is the twofold one of refining both analytical methods and biological methods without confusing the many variables or failing to stress the distinction between vitamins and provitamins A."

Methods for the assay of butter with respect to its carotene and vitamin A contents, details for the assay of blood-serum for its content of vitamin A and carotenoids, and for the determination of carotene in dried grass and similar products, are described in the third chapter.

The water-soluble vitamins C and P and the B complex are treated in the sixth and the seventh chapters. The closely related and physiologically important group of purine and pyrimidine derivatives are dealt with in the eighth chapter. These compounds represent the products of degradation of some of the vitamines, nucleic acids, viruses and coenzymes. As the author remarks, "Spectrophotometric studies on purines are relevant to the study of coenzymes and the data on the pyrimidines to the problem of the structure of aneurin".

A discussion of the position of the absorption spectra of proteins in general, forms the subject of the ninth chapter; excepting for the fact that a spectrographic method for the detection and estimation of tyrosine and tryptophane has been developed, spectroscopy has contributed little to elucidation of the complexity of this class of compounds.

The discussion of purines, pyrimidines and proteins is appropriately and logically followed by the last chapter which gives a clear account of the apo- and co-enzymes of the oxidation-reduction group. Spectroscopy has played a fundamental rôle in the study of these systems; in fact, the only accurate and specific method for determining the activity of many of the coenzyme linked enzymes is the one provided by the spectrograph.

The author has rendered a great service to the science of spectroscopy as applied to the study and elucidation of problems of biochemical interest. The world-renowned and the progressive firm of Adam Hilger has sponsored the publication of this volume.

Annual Review of Biochemistry, Vol. XII. By James Murray Luck and James H. C. Smith. (Annual Reviews, Inc., Stanford University P.O., California), 1943. Pp. ix + 704 Price $5.00.

The impression created by a cursory glance of the Annual Review for 1943, is one of satisfaction that the progress of biochemical science has not been appreciably affected by the unhappy and emergent conditions imposed on scientific research by the global war; the volume of work as reviewed in the volume appears to be substantial in spite of the fact that much of the work conducted in the central and occupied Europe and in Japan has not generally been available to the reviewers.

The volume consists of twenty-four reviews and covers as usual, the fields of biological oxidations and reductions, enzymes, harmones, vitamins and viruses, metabolism of carbohydrates, fats, proteins, amino acids, minerals and sulphur compounds, the chemistry of steroids, lipins, carbohydrates, proteins and amino acids. Other topics reviewed include animal pigments, synthetic drugs, photosynthesis, carbon-dioxide assimilation by heterotropic organisms, electron microscope in biology and micro-chemistry.

The fat-soluble vitamins has been reviewed by Hickman who is one of the pioneers in the application of the principles of molecular distillation to the isolation and production of integrally pure vitamins and vitamin concentrates. He refers to some of the spectacular achievements in this field, still in the course of publication. The occurrence of what the author calls a post-vitamin (kitol) in whale oil, which on simple distillation gives rise to vitamin A, has been announced. This pyrolytic conversion of kitol into vitamin A represents the first instance of the *in vitro* transformation of a pro-vitamin into a vitamin. The next few years will no doubt witness a rapid development not only in the chemistry and biogenesis of this interesting product but also in the commercial production of vitamin A from this source.

The assimilation of carbon-dioxide by heterotropic organisms has formed the subject-matter of several reviews during the last two years. Another review on the same subject by one of the foremost workers in the field deals with the phenomenon as revealed by micro-organisms and serves to elucidate the mechanism and significance of carbon-dioxide assimilation. Attention should be specially invited to the thought-provoking review on the water-soluble vitamins by Roger J. Williams, who has discussed and critically appraised such of those pieces of work "which contribute new and crucial information regarding the chemistry or biochemistry of vitamins" and "which are most stimulative of further research along these lines". The relation of the vitamins of the B-complex to general metabolism, to embryonic development, to chemo-therapy, to harmonal control and to some of the diseases like pernicious anæmia and cancer. Particularly interesting is the suggestion that the B-vitamins influence the mental and psychological qualities in man. Reference is made to the unsatisfactory state of the chemistry of pyridoxin and evidence has been adduced to the occurrence of a pseudopyridoxin which, towards certain organisms, is a thousand times more active.

There is a review on the Electron microscope in Biology by L. Marton, a subject which is coming into practical prominence in recent years. With the aid of this new and powerful tool, deeper insight has been gained into the morphology of micro-organisms, the architecture of viruses and the adsorption phenomena.

The chemistry of viruses is discussed by Hoagland, with special reference to the animal viruses which have not been obtained in a state of the same degree of purity which characterises plant viruses. The author sounds a note of warning that "as a consequence of the great advance which has been made in an understanding of the properties of plant viruses, there has been * * * a too hasty extension of ideas gained from these studies to the formation of over simplified concepts of viruses in general, and animal viruses in particular".

In the preceding paras, reference has been made only to a few of the more important high-lights of biochemical research reviewed in the volume. Biochemical investigators throughout the world are familiar with these publications and will continue to eagerly look forward to its annual appearance.

FOREST TREE SEED*

SEEDS are verily the stuff on which life is sustained. Man's use of food of grain, millets and pulses, is merely incidental in the complex pattern wherein Nature, to ensure the perpetuation of the species thoughtfully provides bountiful harvests of seeds. No wonder, therefore, that man's interest in seeds is primeval. But, such interest has by no means been confined to the merely utilitarian plane. The scientific interest of seeds is compelling. For, seeds, as one authority graphically puts it, represent concentrated life. Neither 'living' nor 'dead' as these words are understood in common parlance, seeds are in a state of suspended animation. Some can remain so for hundreds of years. And, who amongst us has not pondered and been awed and humbled at the thought of a tiny seed growing up to a giant of a tree in the forest? If only trees could speak and tell their tales! No wonder that the poet and the philosopher have succumbed to the beauty and the mystery of seed, as in this delicious ditty:

In the heart of a seed
Buried deep, so deep,
A dear little plant
Lay fast asleep
'Wake' said the sunshine,
'And creep to the light';
'Wake' said the voice
of the raindrops bright
The little plant heard,
And it rose to see
What the wonderful
Outside world might be!

Or again as evidenced by Shelley's immortal lines:

"Oh thou
Who chariotest to their dark wintry bed
The winged seeds, where they lie cold and low
Each like a corpse within its grave, until
Thine azure sister of the spring shall blow
Her clarion o'er the dreaming earth ..."

The latter lines appropriately form part of the preface of a fascinating volume on "Forest Tree Seed", recently published in the United States. Here, within the compass of twenty chapters, is a sufficient and well-arranged summary of the most significant research work in recent years on Forest Tree Seed.

When one ponders over the importance of seed to forestry practice, it is surprising that there should be such paucity of literature in the form of books. The classics on the subject in German are now largely out of date. The more recent text-books on Sylviculture are not (they are not intended to be) comprehensive on the subject of forest tree seed. At the same time, a large amount of data, of use to the Forester and value to the investigator, have appeared—scattered in a number of journals, some of them obscure or not readily available. "Such defects", says Dr. Baldwin, in his preface, "in our methods of disseminating the results of scientific study must be remedied by an occasional synthesis and digestion of the scattered information, and concentration in a single publication." "Forest Tree Seed" is the result.

The author has specialised in this subject for a number of years having had first-hand knowledge of it in America and in the leading forestry centres in Europe. He has devoted no less than fifteen years in garnering the material for this book and during this time he has had the good fortune of the co-operation of "a large number of persons who have co-operated in the preparation of this short volume. The number probably exceeds 100"; this list includes some of the most famous names in the Forestry and Plant Research world of America. Above all is the author's infectious enthusiasm of the devotee to his subject and it is, therefore, no wonder that Dr. Baldwin has produced a volume which bids fair to be the standard book on the subject for a long time to come. And as is to be expected of any Chronica Botanica publication, the get-up of the book is excellent—even sumptuous for a war-time publication.

The volume maintains an even balance between the "purely scientific" and the "practical and applied" aspects of the subject. The anatomy, chemistry and physiology of the seed are dealt with adequately while seed collection, extraction, storage and the biotic enemies of seeds are studied in greater detail, with special reference to North American forest stands. Chapters 8 to 13 on the chemistry of seed germination offer a rich storehouse to the research worker while the following five chapters deal with the purity, determination of origin, viability and germination of seeds—subjects of great importance to the practising forester. Seed testing stations form the subject of Chapter 18 while the penultimate chapter, 19, is short but suggestive on the design and conduct of seed research projects. In this chapter, the author approvingly quotes Donald Peattie: "If there is any living thing which might explain to us the mystery beyond this life, it should be seeds." That about neatly epitomises the spirit of eager enquiry which permeates the entire volume.

One of the most valuable features of the book is the bibliography, extending in all to about a thousand references appended at the end, to each chapter. "References have, as a rule, been listed only at the end of the first chapter in which they occur" (p. 10). This is not conducive to ready reference at later stages in the book when the reader is compelled for tracing the original paper of a citation, to first refer to the name index, find out which the first citation in the book to this particular author is and then back-refer to this chapter for getting at the original paper. Such needless annoyance could easily be avoided by simply listing *all* references at the end of each chapter. Any repetition would be occasional and not materially add to the bulk of the book. An Author Index and an

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* ***Forest Tree Seed** of the North Temperate Regions, with special reference to North America* by Henry Ives Baldwin (Chronica Botanica Ltd., Waltham, Mass., Calcutta: Messrs. Macmillan & Co. Ltd.), 1942, Pp. 16 + 240, Price 4·75 dollars.

Index of Plant and Animal Names make for ready reference while a Glossary of tree seed terms with their French, German, Danish, Norwegian and Swedish equivalents is welcome to the research student who has to consult literature emanating from the continental research stations.

One could wish that State Legislation relating to forest seed and trade in the progressive countries had been dealt with in slightly greater detail than in Chapter XVIII for such legislation has proved to be the bed-rock on which the improvement of Forest Stands in some continental countries has been attempted. Also, the statement on p. 214, "Artificial sowing of tree seeds is at best a poor imitation of Nature's way of producing forests", would appear to many foresters as much too sweeping a generalisation. The fine, extensive, even aged crops in the central European forests and of our own successful teak plantations are examples of what "Artificial sowing" can achieve.

Dr. Baldwin's "Forest Tree Seed" is an unusually well-written and comprehensive volume which is indispensable to the research worker and of great use to the professional forester—yes, even to the forester in India although the book is avowedly written "with special reference to North America". In fact, less than about half a dozen author references relate to work done in India. But the general principles relating to seed collection, cleaning, storage and germination are by no means merely local in application. This book should be specially useful to the Indian forester in its revelation of the large amount of work of practical value being done elsewhere on forest tree seed and in its suggestiveness in planning research for Indian species and under Indian conditions.

Such planned work on forest tree seed is urgently called for in India. It is only comparatively recently that, even in the case of the more important species, empirical nursery methods have been subjected to rigorous scientific investigation. Empirical methods may be good. But, they are not enough. Even the very concepts of tree races have undergone profound changes as a result of recent work. Thus, Dr. Baldwin quotes Münch who "goes so far as to say that races have nothing to do with morphological differences, which may be superimposed upon fundamental physiological adaptations" and that "Pine in different places of its range belongs to the same species only in external appearance" (p. 29). Such revolutionary advances in our knowledge of forest trees must be taken note of and translated into current Indian practices. It is more than likely that in the post-war world, the importance of wood as the raw material of industry will transcend the utility of wood as a mere material of construction and that our prevalent notions of the relative values, commercially speaking, of Indian timbers will be profoundly altered. Comparatively limited as India's resources in coal and iron ores are, it is not unlikely that the future expansion of Indian industry will witness an increasing prominence of cellulose as raw material—a material which her climatic conditions enable her to produce abundantly and cheaply. So great indeed are the basic advantages which India enjoys in this respect that it is freely predicted that the Indian industries of tomorrow will be *cellulose* industries. And, for this purpose, the accepted technique is the production of forest crops of *short* rotation in compact plantations. The raising of such plantations as feeders of raw material to Indian industry compels the adoption of the most scientific practices in relation to forest tree seed in India.

There is one other and very important reason as to why the publication of Dr. Baldwin's book just now is particularly welcome. The vital needs of war have compelled the production and use of enormous quantities of timber; and, in some cases at least, the limits to such production have been factors other than what is accepted to be sylviculturally sound for the particular forest stand. It is, therefore, obvious that large-scale reafforestation programmes have to be undertaken in the years immediately following the war to restore and improve forest stands. As a matter of fact, such reafforestation programmes form a prominent feature of the post-war reconstruction plans of several countries. To take but one example, the Report on Post-War Forest Policy, just published, of the Forestry Commission of Great Britain, envisages five million acres of woodlands as the aim for Great Britain. Similar plans and specific programmes are being drawn by authoritative agencies in other countries. Here in India will also be presented to foresters a great opportunity. Here and now is the time to take stock of Indian needs and prepare programmes for Indian conditions. The provision of adequate quantities of tested seed of suitable strain should be an integral part of any such programme.

'As you sow, shall you reap.' Forestry has special reasons to be mindful of this ancient adage. For, forest crops are generally harvested long after they are born and effects traceable to seed may not be felt or even become apparent for several decades. At that stage of the crop, corrective measures are usually limited to sylvicultural operations which, even if not ruled out on other considerations, are apt to be costly. The forester pays and pays dearly for his sins of omission and commission in his choice of seeds. It is but common prudence that he should not commit such errors which, with a little knowledge, are easily avoided and at the same time adopt practices which are proved to be sound. For this, he could, to start with, do no better than delve into the mine of information contained in "Forest Tree Seed".

SCIENCE NOTES AND NEWS

Post-War Organisation of Scientific Research in India.—We wish to invite the attention of our readers to the highly thoughtful and informative inaugural address delivered by Sir J. C. Ghosh, Director, Indian Institute of Science, before the National Institute of Sciences on the occasion of the Symposium on Post-War Organisation of Scientific Research. The address appears in the October 1943 number of *Science and Culture*.

Co-ordination of Agriculture and Industry.—Inaugurating a new Industrial Enterprise for the Production of Heavy Chemicals in the State, Sir C. P. Ramaswami Aiyar, Dewan of Travancore, declared: "It is the policy of His Highness' Government—a policy it is my duty and privilege to promote to the maximum extent possible—that this State should repair the past neglect of industrial development throughout India as a whole and this State in particular and take advantage of our abundant natural resources and intelligence of the people so as to bring about that co-ordination between agriculture, industry and manufacture, without which national prosperity would not be achieved. I am deliberately mentioning three things, namely, agriculture, industry and commerce, because in conditions of India today, and *a fortiori* in the conditions of Travancore to-day, the welding of these three activities is a problem of utmost urgency."

"Travancore", he added, "does not wish to continue for ever to go about with beggar's bowl, though her present needs are greater intrinsically than those of the localities which are so much in evidence to-day and which, while producing eighty centum of their foodstuffs, go on asking for more and more food. Much needed provisions are not unfortunately made available to the people at large who cannot make their voices heard. This maldistribution is most prejudicial to the legitimate claims of localities which produce only forty centum of their requirements and had been relying in the past on imports for their bare subsistence and grew commercial crops needed by the world at large. We have to impress on the world that enterprises like the present are not luxuries at this juncture and the Central Government should give them all necessary facilities by way of priorities, etc. Unless we extend and intensify our cultivation, we shall continue to suffer and are too far away for our troubles to be rightly appreciated and remedied."

Production of Fertilisers.—A conference of the representatives of chemical industry and of the Supply, Food and Commerce Departments, was held in New Delhi to consider methods of increasing the production of fertilisers, particularly of ammonium sulphate. The Session was presided over by Sir A. Ramaswami Mudaliar and the deliberations lasted for two consecutive days (September 29 and 30, 1943).

The consumption of ammonium sulphate in India, which went up steadily in the pre-war years to 96,000 tons per annum, has fallen since 1939-40, mainly due to restrictions of imports resulting from the war. The need for increasing production from indigenous sources, both on a short-term basis and from the point of view of long-term possibilities, was emphasised at the first day's session.

A committee, with Sir P. M. Kharegat, Vice-Chairman of the Imperial Council of Agricultural Research, as President, and Messrs. Kapilram Vakil, Gilmour, Shankarlal, Davies, Parker, Krishnaswami, Modi and representatives of the Government, was formed.

The Conference resumed its session on the following day; several representatives of industry expressed their readiness to put up plants, subject to assistance which the Government could render. The Conference considered the report of the Sub-Committee appointed on the 29th, which examined the possibilities of new production within the next two years, the most easily available resources which could be exploited and the assistance that would promote the proposed expansion of the industry.

The Committee estimated the existing capacity for production of ammonium sulphate at about 30,000 tons against the Food-Grains Policy Committee estimate of 350,000 tons a year required as fertilisers if India's dependence on imports of rice was to be reduced. A total production of 350,000 tons from the new plants proposed to be started within the next two years was considered feasible.

The most urgent problem consisted in the importation of the necessary plants and the difficulties imposed by the war conditions. The Government will, however, actively pursue the question of importing plants as the first step in the scheme of expansion.

Jute Position in 1942-43.—Reviewing the jute position in 1942-43, the September issue of the Indian Central Jute Committee *Bulletin* states that (1) difficulties of shipping, (2) regulation of jute crop in Bengal, and (3) difficulties of internal transport were the chief events which affected the jute position during the period.

The first restricted the effective demand for jute; the second was an attempt to adjust supply to demand; while the third tended to upset the balance that was expected as a result of the former two. The net position was that there was no marked improvement or deterioration in the jute trade as a whole.

Cotton and paper for manufacture of bags to substitute burlap not being available in anything like the volume required, the shortage of bag supply continued in the U.S.A.

Recent news received from South America indicates that there is still no material change

in the bag supply situation in the Argentine, where shortage continues.

In Brazil the co-ordinator of Economic Mobilisation has authorised the creation of a special body to control the production and distribution of various national fibres, as well as the manufacture and sale of their products. Amongst other things, the new body is empowered to take steps to increase the proportion of national fibres used by local manufacturing concerns. The Brazilian Government has approved a plan for the encouragement of the cultivation of flax, and official steps to increase the output of "Ramie" fibre are also to be taken.

Grow More Rice.—One of India's most urgent needs to-day is the production of more rice. Thus it is gratifying to find that amongst the 39 sections which have been incorporated in the forthcoming 'Art in Industry' Exhibition which is to take place in Calcutta early in 1944, there is one section devoted to 'Grow More Rice' propaganda. Artists are asked to send in designs for posters and it is hoped that this will be one of the most popular sections in the Exhibition, because, apart from the inducement of big prize money to artists, it is linked up with the nation's most vital interest.

National Research Council.—The Council of the National Institute of Sciences of India was authorised to take necessary steps for the organisation of a National Research Council constituted under the statutory authority of the Government of India, at the symposium on Post-War Organisation of Scientific Research, held this month in Calcutta. It was also decided to approach the Government of India for an annual grant of five crores of rupees to enable the Council to give effect to its policy of scientific development.

The symposium considered that the National Research Council should be directly responsible to the Government. Its main functions should be to plan the main lines of scientific work in accordance with national needs, to ensure balanced development of all branches of science and advise and help regarding training and supply of scientific personnel for pure and applied research. The Council should consist of scientific and technical experts not exceeding sixty in number, the majority of whom should be elected by non-official scientific organisations, including universities. Boards of research should be constituted for each sphere of work, and each board should be authorised to constitute research committees on all important subjects.

Sir Dorabji Tata Trust.—Donations to the extent of over 60 lakhs of rupees have so far been made by the Sir Dorabji Tata Trust, which has now completed its ten years of service in the cause of education and humanity. They cover a wide range of charitable objects in every part of India, and in a few cases in response to appeals from overseas.

The largest single project undertaken by the Trust has been the establishment and maintenance of the Tata Memorial Hospital for Cancer; this was brought into existence in 1940 at a capital cost of Rs. 23 lakhs and is maintained at an annual expenditure of Rs. 4 lakhs. The Tata Graduate School of Social Work, which trains young men and women from the universities in social work, is the first institution of its kind in India and has already proved to be of great service. The School is maintained at an annual cost of over Rs. 50,000.

Scientific and technical education has received particular attention from the Trust. Nearly 300 men and women have received assistance for prosecuting their studies at home and abroad. In pursuance of this commendable policy, the Trust, jointly with the Tata Iron and Steel Co., have recently donated Rs. 8,30,000 towards the establishment of a National Chemical Laboratory at Poona. The Calcutta University was also financed to instal a Cyclotron at a cost of Rs. 60,000.

Besides, the Trust have donated over Rs. 5 lakhs for the relief of sufferers in the Bihar and Quetta earthquakes, the Midnapore Cyclone and the present Bengal famine.

We wish to tender our grateful appreciation of the munificence which has always characterised the great and illustrious family of the Tatas.

Wood and War.—Addressing the fifty-first annual meeting of the International Concatenated Order of Hoo Hoo in Milwaukee, Wis., on September 10, 1942, Dr. Carlile P. Winslow, Director, Forest Products Laboratory, Madison, Wis., declared, "In the popular mind this is a war of dive bombers and high-speed armoured divisions—yet to make this war of machines function requires a larger quantity and variety of forest products than has been used in any previous war. As a matter of fact, this has been recognized by the Germans for a long time. Three years ago this month, before leaving Germany, I learned that Goering had put wood second on his list of essential materials—second only to steel.

The list of wood items demanded by war's insatiable appetite goes on and on—wood for hangers, scaffolding, boats, wharves, bridges, pontoons, railway ties, telephone poles, mine props, anti-tank barriers, shoring, shipping containers, and air-raid shelters; plywood for airplanes, black-out shutters, prefabricated housing, concrete forms, ship patterns, assault boats, ship interiors, truck bodies and army lockers; fuel for gasogense, for trucks and tractors; pulp and paper for surgical dressings, boxes, cartridge wrappers, building papers, pasteboards, gas-mask filters, printing, and propaganda distribution; synthetic wood fibres, such as in rayon, artificial wool and cotton, for clothing, parachutes and other textiles; wood cellulose for explosives, wood charcoal for gas-masks and steel production; rosin for shrapnel and varnishes, turpentine for flame throwers, paint and varnishes; cellulose acetate for photographic film, shatterproof glass, airplane

dopes, lacquer, cement and moulded articles; wood floor for dynamite; wood bark for insulation, tannin, and dyestuffs; and alcohol from wood for rubber. Only recently the Government has ordered that all Army truck bodies shall be built of wood to conserve steel—a use that is currently requiring approximately a million feet of hardwood a day.

The amount of lumber used for containers is almost unbelievable. The number of boxes required for the shipment of ammunition alone runs into thousands per day. It is estimated that more than 7 billion—not million—board feet of lumber will be required for containers in 1942 and a substantially greater amount in 1943.

All told our lumber needs this year (according to the War Production Board) will exceed 39 billion board feet. Actually we are estimated to be cutting only 33 billion feet. A stock pile of some 5 billion feet in the hands of manufacturers is rapidly vanishing in the face of this gap between production and consumption.

MAGNETIC NOTES

Magnetic conditions during September 1943 were slightly less disturbed than in the previous month. There were 5 *quiet* days, 21 days of *slight* disturbance and 4 days of *moderate* disturbance as against 13 quiet days, 16 days of slight disturbance and one of moderate disturbance during the same month last year.

The quietest day during September 1943 was the 24th and the day of the largest disturbance was the 29th.

The individual days during the month are classified as shown below:—

Quiet days	Disturbed days	
	Slight	Moderate
6, 7, 18, 20, 24.	1–5, 8–17, 19, 21–23, 26, 27.	25, 28–30.

No magnetic storm occurred during the month of September in the years 1942 and 1943.

The mean character figure for the month of September 1943 was 0·97 as against 0·60 for September last year.

M. V. SIVARAMAKRISHNAN.

Medical History Exhibition.—Dr. D. V. S. Reddy, Andhra Medical College, Vizag, writes to us as follows:—

Medical men who have attended the meetings of the British Medical Association or even read *Proceedings* of the above meetings in Oxford, Cambridge, London or Australia, may remember how interesting and instructive medical history exhibitions can be.

As early as in 1936, I published a plea (see my letter in *British Medical Journal*, dated 21st November 1936) requesting that the rare and instructive Indian medical manuscripts in Oxford, Cambridge and London may also be exhibited along with the British, European and Arabian exhibits, at the time of the meetings of the British Medical Association. Professor Charles Singer of London, who communicated my letter to *B. M. J.*, stated that he and the Editor of the *B. M. J.* fully endorsed my plea.

I have also made a plea for similar medical history exhibitions in India in a paper read before the Medical Section of the Indian Science Congress held at Calcutta in January 1938 and that paper, "A plea for the promotion for the study of history of medicine", has been printed in the *Journal of the Indian Medical Association*, September issue, 1938.

At the Madras Session of the Science Congress in 1940 in my paper, "The present position of the history of medicine in India" (*J. Ind. Med. Assn.*, May 1940), I made the following appeal: "Another matter which has been sadly neglected and which deserves the attention of all organisers of conferences and congresses is the value and inspiration of an exhibition of old books, manuscripts and printed ones, illustrating the progress of medicine in space and time. ... Indian cities where medical conferences are held are rich in materials for such exhibition and with the co-operation of the University Library, Oriental Libraries or private learned bodies, it should not be difficult to organise a fairly representative exhibition of rare and old manuscripts of early printed editions of portraits and paintings pertaining to medicine and of medical relics and curiosities." In the ensuing discussion, some leading members of the medical section and professors of the Medical Colleges at Madras asked me if I could not arrange for such an exhibition for the next day. I pointed out that I would be able to do so if the local Secretaries of the Reception Committee could persuade the authorities of the Medical College Library and the University Library and the Oriental Library to lend certain of the exhibits.

Now that the Indian Science Congress is holding its session in a State famous for the promotion of Oriental studies and publications, as well as for the collection of art treasures and archæological relics, I would appeal, in my individual capacity as a student of History of Medicine and in a representative capacity as the corresponding member of the American Association of the History of Medicine, to the organisers and Reception Committee of the Science Congress in Trivandrum, to take the initiative and have, side by side with the usual industrial or commercial or scientific exhibition, a cultural and medico-historical exhibition of the type till now arranged only in America and Europe.

LIST OF EXHIBITS TO BE COLLECTED AND INCLUDED

1. Gods of Healing.—(*a*) Idols, (*b*) Dolls, (*c*) Plaques, (*d*) Stone panels, (*e*) Images, (*f*) Pen and ink sketches, (*g*) Paintings on paper or glass, (*h*) Reproduction of wall paintings, (*i*) Photos of temples or of idols of gods worshipped in the State for special diseases, (*j*) Votive offerings.

II. Medicine in Art.—(*a*) Stones, sculptures or panels or paintings or outline drawings illustrating incidents from Indian legends or epics showing the wounded or the sick or treatment of the sick.

III. Medical Manuscripts.—(*a*) Ancient and mediæval Sanskrit medical classics; (*b*) Manuscripts in South Indian languages; (*c*) Manuscripts in European languages (Portuguese or English records dealing with medicines or diseases or physicians).

IV. Early Printed Books in Medicine.—(*a*) Books in European languages (Portuguese and English, etc.); (*b*) Books in South Indian languages, (*c*) Books in Sanskrit.

V. Relics of Medical Interest.—(*a*) Flints, bones, knives, lancets, forceps, splints; (*b*) Containers of medicine mortars, etc.

VI. Records of Heriditary Physicians.—(*a*) Family genealogy with sketches or notes on physicians and note books on medicine kept by families; (*b*) Records of 17th and 18th century missionaries dealing with medical relief; (*c*) Records, sketches and descriptions of the early Portuguese, English or other hospitals in the State and surrounding areas.

VII. Description of epidemics or special diseases from State records or private records.

VIII. Medical Lore in Literature.—(*a*) Any Malayalam classics, describing doctors or their work with a short abstract in English; (*b*) Books dealing with merits and virtues of sacred places and mineral springs.

IX. Medicine in Folklore.—(*a*) Sayings or songs; (*b*) Armlets and charms.

X. Books on the History of Medicine.—(*a*) Books dealing with history of medicine in general; (*b*) Books dealing with special branches of medicines; (*c*) Books dealing with history of medicine in India; (*d*) What other countries are doing for the promotion of the studies in history of medicine.

The All-India Manufacturers' Organization.—At a meeting of prominent businessmen, financiers and industrialists held recently at Nagpur and addressed by Mr. Sankalchand G. Shah, Vice-President of the A.-I.M.O., the C.P. and Berar Provincial Board of the Organization was started in order to carry out the programme of industrialization in the Province.

The following office-bearers were elected:—Sir Madhavlal Despande (*President*), Shrimant M. G. Chitnavis (*Vice-President*), Seth S. R. Surana (*Vice-President*), and Mr. D. W. Mandpe (*Secretary*).

We acknowledge with thanks the receipt of the following:—

"Journal of the Royal Society of Arts," Vol. 91, Nos. 4642, 4643 and 4645.

"Journal of Agricultural Research," Vol. 66, Nos. 10-12.

"Agricultural Gazette of New South Wales," Vol. 54, Pt. 8.

"Allahabad Farmer," Vol. 17, No. 4.

"Calcutta Review," Vol. 89, No. 1.

"Journal of the Indian Chemical Society," Vol. 20, Nos. 8 and 9.

"Journal of Chemical Physics," Vol. 11, Nos. 6-7.

"Chemical Products and Chemical News," Vol. 6, Nos. 7-8.

"Experiment Station Record," Vol. 89, No. 1.

"Transactions of the Faraday Society," Vol. 39, Pts. 7 and 8.

"Indian Forester," Vol. 69, No. 10.

"Indian Medical Gazette," Vol. 78, No. 9.

"Review of Applied Mycology," Vol. 22, Nos. 6-7.

"Bulletin of the American Meteorological Society, Vol. 24, Nos. 2 and 3.

"Journal of Nutrition," Vol. 26, No. 1.

"Nature," Vol. 152, Nos. 3844-45, 3849-50.

"Journal of the Bombay Natural History Society," Vol. 44, No. 1.

"Indian Journal of Physics," Vol. 17, Pt. 3.

"Science," Vol. 97, Nos. 2524-27; Vol. 98, Nos. 2530-32, 34-36.

"Science and Culture," Vol. 9, No. 4.

"Monthly Science News," Nos. 23 and 24.

"Sky," Vol. 2, Nos. 8-10.

"Indian Trade Journal," Vol. 150, Nos. 1943-1946.

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The Carnivorous Plants. By Francis Ernest Lloyd. (Messrs. Chronica Botanica Co., Waltham, Mass. Calcutta: Messrs. Macmillan & Co., Ltd.), 1942. Pp. 352. Price $6.

Annual Review of Biochemistry, Vol. 12. By James Murray Luck. (Annual Reviews Inc., California), 1943. Pp. 704. Price $5.

Annual Review of Physiology, Vol. V. By James Murray Luck. (American Physiological Society and Annual Reviews Inc., Calif.), 1943. Pp. 613. Price $5.

Indian Village Health. By J. N. Norman Walker. (Oxford University Press, Madras), 1943. Pp. 99. Price Rs. 2-8-0.

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